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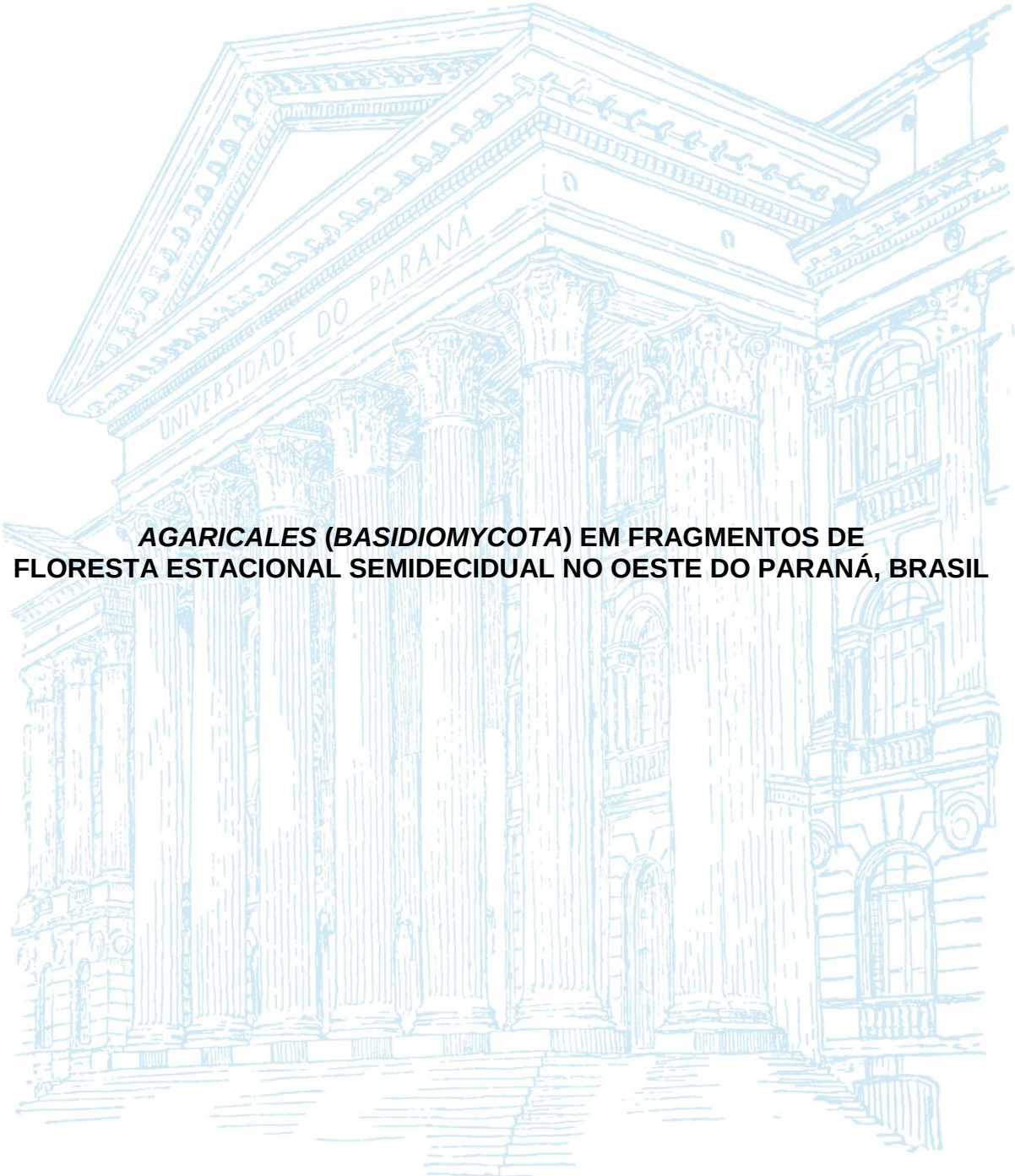

AGARICALES (*BASIDIOMYCOTA*) EM FRAGMENTOS DE FLORESTA ESTACIONAL SEMIDECIDUAL NO OESTE DO PARANÁ, BRASIL

CURITIBA
2017

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Dissertação apresentada ao programa de Pós-Graduação em Botânica, área de concentração Biologia e Diversidade de Algas Liquens e Fungos, Setor de Ciências Biológicas, Universidade Federal do Paraná, como requisito parcial para a obtenção do título de Mestre em Botânica.

Orientador: Dr. Vagner Gularte Cortez

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"*AGARICALES* (*BASIDIOMYCOTA*) EM FRAGMENTOS DE FLORESTA ESTACIONAL SEMIDECIDUAL NO OESTE DO PARANÁ, BRASIL."

por

Alexandre Gonçalves dos Santos e Silva e Filho

Dissertação aprovada como requisito parcial para obtenção do grau de Mestre no Programa de Pós-Graduação em Botânica, pela Comissão formada pelos doutores

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Curitiba, 30 de janeiro de 2017

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RESUMO

Agaricales reúne fungos que produzem basidiomas predominantemente agaricoides, mas também abrangem formas gasteroides, secotioides, cifeloides, poroides, clavarioides e corticioides. No Brasil estão registradas atualmente 926 espécies, com numerosos registros na região sul, principalmente nos estados do Rio Grande do Sul e Paraná. No Paraná, mais de 600 espécies são mencionadas na literatura, porém os estudos se concentram em áreas de Floresta Ombrófila Mista e Densa. Com o objetivo de contribuir ao conhecimento da micobiota da Floresta Estacional Semidecidual do oeste do Paraná, o presente trabalho apresenta resultados do levantamento de *Agaricales* na região. As coletas foram realizadas entre Janeiro e Dezembro de 2015 no Parque Estadual de São Camilo, e Reserva Particular do Patrimônio Natural Fazenda Açú remanescente de Floresta Estacional Semidecidual, localizados nos municípios de Palotina e Terra Roxa, respectivamente. O estudo compreendeu análise morfológica (macroscópica e microscópica) e identificação dos espécimes, segundo a literatura especializada. Os espécimes foram preservados no Herbário do Campus Palotina (HCP) e os holótipos no Herbário do Departamento de Botânica (UPCB), ambos da Universidade Federal do Paraná. Foram analisados 578 espécimes, representando 76 espécies, distribuídas em 49 gêneros de 16 famílias. *Clitocella pallescens* e *Panaeolus silvaticus* são propostas como novas espécies para a ciência. *Clitocella himantiigena* é proposta nova combinação. *Copelandia mexicana*, *Crepidotus mexicanus*, *Tricholosporum tropicale* e *Tubaria bispora* são novos registros para a América do Sul. O gênero *Clitocella* é citado pela primeira vez no Brasil. *Agaricus ochraceosquamulosus, Clitocella himantiigena, Gymnopilus chrysopellus, Leucoagaricus coerulescens, Marasmiellus atrosetosus e Rhodocybe galerinoides* são novos registros para o Brasil. *Agaricus endoxanthus*, *Crepidotus crocophyllus*, *Hohenbuehelia mastrucata*, *Lepiota lilacea, Leucocoprinus straminellus*, *Mycena euspeirea*, *Mycena holoporphyra*, *Pleurotus opuntiae* e *Psilocybe yungensis* são novos registros para o Estado do Paraná. Outras 29 são novas ocorrências para Floresta Estacional Semidecidual do estado do Paraná. O grande número de espécimes coletadas assim como o de espécies identificadas demonstra que esse é um grupo bastante diverso nos estudos de diversidade de Fungos s.l. e também amplamente diverso nesse ecossistema. A continuidade desse estudo com ênfase em grupos pouco estudados deve revelar novos registros de espécies ainda desconhecidas para a região assim como novidades taxonômicas.

Palavras-chave: Agaricomycetes, biodiversidade, Floresta Atlântica s.l., taxonomia

ABSTRACT

Agaricales comprises mushrooms producing mostly agaricoid basidiomata, but other types are also included, as the gasteroid, secotioid, ciphelloid, poroid, clavarioid and corticioid. In Brazil, 926 species belonging to the *Agaricales* have been reported, with numerous records from South Brazil, especially from Rio Grande do Sul and Paraná States. From the State of Paraná, about 600 species are reported, although most of the studies surveyed areas of Mixed and Dense Ombrophilous Forests in the State. Aiming to survey the mycobiota from the Seasonal Semideciduous Forests from the western region of Paraná State, the present focused on the *Agaricales*. Fieldwork was carried on from January to December 2015, in two localities: Parque Estadual de São Camilo, municipality of Palotina, and Reserva Particular do Patrimônio Natural Fazenda Açú, municipality of Terra Roxa. The investigation comprised morphological (macro-and microscopical) of the basidiomata, and taxonomic identification. Specimens were preserved at the Herbário of Campus Palotina (HCP) and holotypes at the Herbário of Departamento de Botânica (UPCB), both at the Universidade Federal do Paraná. All were 578 specimens were identified, comprising 76 species, 49 genera and 16 families. *Clitocella pallescens* and *Panaeolus silvaticus* are proposed as new species. *Clitocella himantiigena* is a new combination and the genus *Clitocella* is reported from the first time in Brazil. *Copelandia mexicana*, *Crepidotus mexicanus*, *Tricholosporum tropicale,* and *Tubaria bispora* are new records from South America. *Agaricus* cf*. ochraceosquamulosus, Clitocella himantiigena, Gymnopilus chrysopellus, Leucoagaricus coerulescens, Marasmiellus atrosetosus* and *Rhodocybe galerinoides* are new records from Brazil. Agaricus endoxanthus, Crepidotus crocophyllus, *Hohenbuehelia mastrucata*, *Lepiota lilacea Leucocoprinus straminellus*, *Mycena euspeirea*, *Mycena holoporphyra, Pleurotus opuntiae* and *Psilocybe yungensis* are new records from Paraná State. Other 29 taxa are reported for the first time in the Seasonal Semideduous Forest of western Paraná. The number of collected species, as well the number of identified taxa show that this is a diverse and ecologically significant group of fungi in this ecosystem. Further studies will reveal a more complex and numerous taxa, and the present research furnished a background for future studies.

Key Words: Agaricomycetes, biodiversity, Atlantic Forest, taxonomy

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1. INTRODUÇÃO

1.1 *AGARICALES*

Agaricales Underw, é um grupo de fungos pertencente à classe *Agaricomycetes* Doweld. A maioria dos representantes dessa ordem apresenta em seu ciclo de vida uma fase sexual com produção de uma estrutura reprodutiva o basidioma. Esse basidioma tem forma predominantemente agaricoide, ou seja, carnoso, efêmero, pileado, com estipe central e himenóforo lamelado (GUGLIOTTA; CAPELARI, 1998), podendo apresentar uma grande variação no formato, como tamanho, cor, presença de véu ou volva (HIBBETT et al., 2014). Fungos pertencentes a esse grupo podem ser saprófitas, parasitas, patogênicos (ROSA; CAPELARI, 2009), e ainda estar associados a algas (formando basidioliquens) ou com raízes de algumas plantas (micorrízicos), e ocupam os mais diferentes ecossistemas, incluindo as regiões polares do planeta.

Dentre as formas agaricoides são conhecidas espécies com diversos hábitos. Largent (1986) dividiu o hábito segundo: a inserção das lamelas (livres, adnatas, decurrentes), anel (presença ou ausência), volva (presença ou ausência), estipe (superfície e consistência) e píleo (formato e margem).

Para os fungos agaricoides de lamelas livres, quatro diferentes hábitos são encontrados: 1) amanitoides, com presença de anel e volva; 2) vaginatoide, com anel ausente e volva presente; 3) lepiotoide, com anel presente e volva ausente; 4) pluteotoide com ausência de anel e volva (LARGENT, 1986).

Para os basidiomas sem volva, com estipe carnoso a fibriloso e inserção da lamela variando entre adnexa a decurrente outros 4 tipos de hábito são encontrados: 5) tricolomatoide, com inserção das lamelas variando entre adnexa a adnata, sem anel; 6) armilarioide, com inserção das lamelas variável e presença de anel; 7) clitociboide, com lamelas subdecurrentes a decurrentes e ausência de anel; 8) naucorioide, lamelas adnatas a emarginadas, sem anel (LARGENT, 1986).

Para os basidiomas frágeis com estipe cartilaginoso encontram-se ainda os de hábito: 9) micenoide, com píleo cônico a campanulado, margem reta, lamelas não decurrentes e ausência de anel e volva; 10) colibioide, com píleo convexo, margem incurvada a enrolada, lamelas não decurrentes, anel e volva ausente; 11) onfalinoide, com píleo convexo a plano, umbilicado, margem variável, inserção das

lamelas decurrentes a subdecurrentes, volva e anel ausentes; 12) anelarioide, píleo, margem e lamela variáveis, anel presente e volva ausente (LARGENT 1986).

Entre as configurações não agaricoides encontram-se ainda os hábitos: 13) pleurotoides, sem estipe ou com estipe excêntrico a lateral reduzido; 14) cifeloides, com basidiomas de dimensões reduzidas em forma de taça, tubo ou disco; 15) gasteroides, com o basidioma globoso com o himênio formando lóculos ou lamelas anastomadas, ausência de columela e estipe; 16) secotioides com a mesma configuração dos gasteroides porém com presença de estipe; 17) corticioides, com morfologia efusa e fixos ao substrato de formato ressupinado; e ainda os 18) coraloides em forma de corais (HIBBETT et al., 2014).

Pegler (1983) descreve macroscopicamente os *Agaricales sensu lato* com o píleo entre membranoso a carnoso, mas nunca lenhoso, o himenóforo lamelado como mencionado anteriormente pode ser ainda poroso, tubulado, venoso ou liso. O estipe geralmente presente, central, pode ser lateral, reduzido ou mesmo ausente. Com formato variado, a base do estipe pode ser insertiva ou ainda conter rizomorfas e/ou massa micelial. O véu universal, em algumas espécies, desenvolve estruturas como volva, anel, cortina ou escamas.

Microscopicamente, o basidioma é formado por um sistema hifal monomítico, com presença ou ausência de fíbulas, hifas lisas e/ou incrustradas, apresentar ainda elementos no seu interior como resinas e óleos e/ou pigmentos. Os basidiósporos variam muito no tamanho e formato, podendo ser hialinos, pigmentados, de parede grossa ou delgada, dupla ou simples, dextrinoide, amiloide ou inamiloide em Melzer (SINGER, 1986). Os cistídios são elementos hifais estéreis e estão frequentemente presentes em formatos variados como os leptocistidioides, gloeocistidioides crisocistidioides e metuloidais; estes cistídios estão normalmente presentes no himênio (pleurocistídios e queilocistídios), mas podem estar presentes na superfície do píleo (pileocistídios) e do estipe (caulocistídios). Os basídios geralmente são tetraesporados, podendo ser encontrados também tri-, bi- e monosporados. A superfície do píleo, ou pileipellis, também varia conforme cada grupo (famílias e gêneros, principalmente), onde os mais comuns são: epicutis, epitélio ou tricoderme. A trama da lamela varia entre regular (hifas paralelas), irregular (hifas entrelaçadas), convergente e divergente (LARGENT; JOHNSON; WATLING, 1977; PEGLER, 1983).

1.2 CLASSIFICAÇÃO DOS FUNGOS *AGARICALES*

Através de características macromorfológicas e coloração da esporada, Fries (1821, 1822, 1829) desenvolveu o primeiro sistema de classificação, onde todos os cogumelos carnosos e lamelados foram agrupados no gênero *Agaricus* L. (KIRK et al., 2008). A cor da esporada os separava em outros grupos. Em 1889, o micólogo suíço Victor Fayod reconheceu 108 gêneros por meio de estudos anatômicos e microscópicos dos basidiomas (ZHAO et al., 2008).

Rolf Singer foi o pesquisador com maior contribuição para a taxonomia e nomenclatura de *Agaricales,* especialmente da região neotropical. Em “The *Agaricales* in modern Taxonomy” (1949) ele modificou profundamente a classificação dos *Agaricales*, onde *Agaricus* foi considerado o gênero tipo da família *Agaricaceae* Chevall., que por sua vez é gênero tipo da ordem. Outras mudanças foram propostas em outras edições subsequentes (SINGER, 1975, 1986). Através de caracteres macro e micromorfológicos aliados a métodos químiotaxonômicos ele propôs um novo sistema de classificação separando a ordem *Agaricales* em três subordens: *Agaricinae*, *Boletinae* e *Russulinae*.

Outros dois micólogos que contribuíram para a taxonomia de *Agaricales* com importantes publicações estão: o norte americano Alexander H. Smith, com mais de 200 publicações, entre monografias e livros (THIERS, 1987), e o francês Robert Kühner com aproximadamente 50 publicações (LARMOURE; MILLER JR, 1999).

A sistemática dos *Agaricales* foi drasticamente modificada a partir da incorporação de resultados obtidos a partir de dados moleculares. A divisão da ordem em três subordens, como mencionado, atualmente representam ordens/clados independentes (*Agaricales*, *Boletales* E.-J. Gilbert e *Russulales* Kreisel ex P.M. Kirk, P.F. Cannon & J.C. David) e reúnem, em *Agaricales*, não apenas espécies com tipologia agaricoide, mas também boletoides, cifeloides, corticioides, gasteroides e secotioides (MONCALVO et al., 2002; ZHAO et al., 2008).

Um estudo pioneiro e bastante abrangente foi realizado por Moncalvo et al. (2000) utilizando o DNA nuclear, mitocondrial e ribossomal de representantes de *Agaricales* (lamelados), *Aphyllophorales* (poroides) e *Gasteromycetes* (puffballs). Estes autores demontram que as relações filogenéticas não estão relacionadas à forma do basidioma e do himenóforo, o que de fato já era discutido por Singer (1986) Estes autores identificaram 117 clados monofiléticos, reconheceram o polifiletismo

de *Tricholomataceae* R. Heim, *Cortinariaceae* R. Heim e *Hygrophoraceae* Lotsy, assim como dos gêneros *Clitocybe* (Fr.) Staude, *Omphalina* Quél. e *Marasmius* Fr. Nesse mesmo trabalho, os autores ainda reafirmaram o posicionamento de gêneros clavarioides, poroides, secotoides e gasteroides dentre os demais *Agaricales.*

Em um estudo mais recente, Matheny et al. (2006) reconheceram seis clados principais nos *Agaricales*: plicaturopsidoide: com táxons lamelados, clavados, coraloides, pileado-estipitados e resupinados; pluteoide: correspondendo às famílias *Pluteaceae* Kotl. & Pouzar, *Amanitaceae* R. Heim ex Pouzar e *Pleurotaceae* Kühner; higroforoide: reunindo *Hygrophoraceae* e certos gêneros previamente incluídos em *Tricholomataceae*; marasmioide: integrando *Cyphellaceae* Lotsy*, Marasmiaceae* Roze ex Kühner, *Omphalotaceae* Bresinsky*, Physalacriaceae* Corner e *Schizophyllaceae* Quél.; tricholomatoide: com representantes de *Tricholomataceae s. str.*, *Lyophyllaceae* Jülich, *Entolomataceae* Kotl. & Pouzar e *Mycenaceae* Overeem; agaricoide: incluindo 14 famílias com esporos predominantemente pigmentados, como *Agaricaceae, Bolbitiaceae* Singer*, Cortinariaceae, Inocybaceae* Jülich*, Psathyrellaceae* Vilgalys, Moncalvo & Redhead*, Strophariaceae* Singer & A.H. Sm. entre outras.

De acordo com Hibbett et al. (2014) cerca de 400 gêneros estão distribuídos em 30 famílias, e o clado plicaturopsidoide é confirmado como uma nova ordem, *Amylocorticiales* K.H. Larss., Manfr. Binder & Hibbett.

1.3 ESTUDOS COM *AGARICALE*S NO BRASIL E NO PARANÁ

No Brasil, o estudo dos macrofungos teve início com pesquisas realizadas por naturalistas e botânicos estrangeiros como Link, Ehrenberg e Martius (Fidalgo, 1968). Posteriormente, outros autores descreveram e citaram dezenas de espécies de macrofungos brasileiros, tais como Montagne (1834), Berkeley (1843, 1956) e Spegazzini (1889), impulsionando o conhecimento da micobiota brasileira.

Diversas publicações de Rick (1906, 1907, 1920, 1930, 1937, 1938, 1939, 1961), Singer (1954, 1986, 1989) e Pegler (1990, 1997) permitiram ampliar substancialmente o conhecimento sobre os *Agaricales* brasileiros, sendo que suas contribuições ainda são relevantes e citadas ainda hoje.

Atualmente, trabalhos taxonômicos e de filogenia tem revelado novas espécies para o Brasil, assim como levantamentos tem sido feitos em várias

localidades, demonstrando a riqueza dos fungos agaricoides, como em *Agaricaceae* (CAPELARI; GIMENES, 2004; CORTEZ; BASEIA; GUERRERO, 2006; FERREIRA; CORTEZ, 2012; ALVES; CORTEZ, 2013a; TRIERVEILER-PEREIRA; BASEIA, 2013), *Amanitaceae* (WARTCHOW; MAIA, 2007; MENOLLI; ASAI; CAPELARI, 2009; MENOLLI; CAPELARI; BASEIA, 2009; FERREIRA; WARTCHOW; CORTEZ 2013), *Entolomataceae* (WARTCHOW, 2006; KARSTEDT; CAPELARI; STÜRMER, 2007; KARSTEDT; CAPELARI, 2013), *Crepidotaceae* (CAPELARI, 2007; CAPELARI, 2011), *Hymenogastraceae* (GUZMÁN; CORTEZ, 2004, 2005; SILVA et al., 2007), *Inocybaceae* (SULZBACHER; COELHO; CORTEZ, 2009; WARTCHOW; SILVEIRA; SÁ, 2014, WARTCHOW; MAIA; CAVALCANTI, 2008), *Marasmiaceae* (OLIVEIRA et al., 2008; CORTEZ; SULZBACHER, 2009; COIMBRA; GILBERTONI; WARTCHOW, 2012, 2013), *Mycenaceae* (DESJARDIN; CAPELARI; STEVANI, 2005, 2007; PINHEIRO; SÁ; WARTCHOW, 2013), *Physalacriaceae* (CAPELARI; GUGLIOTTA, 2005; WARTCHOW, 2010; WARTCHOW et al., 2010), *Pluteaceae* (WARTCHOW; CORTEZ; COELHO, 2004, 2006; MENOLLI; CAPELARI, 2010; PUTZKE; WARTCHOW, 2008, DIAS; CORTEZ, 2013, WARTCHOW, 2009), *Strophariaceae* (CORTEZ; COELHO, 2003, 2004; SILVA; CORTEZ; SILVEIRA, 2006, 2009, 2012).

No Brasil estão registradas 926 espécies de *Agaricales* (incluindo 55 variedades e três subespécies) distribuídas em 139 gêneros (MAIA et al., 2015). Dentre essas, 456 espécies são registradas para o Bioma Mata Atlântica (MAIA et al., 2015).

No Paraná, os macrofungos das Florestas Ombrófilas Mista e Densa são os mais bem conhecidos devido a investigações realizadas nas regiões leste e central, cerca de três décadas, pelo naturalista André de Meijer (2001, 2006, 2008, 2010). Em uma lista de revisão dos macrofungos do Paraná (DE MEIJER, 2006), incluindo *Agaricales*, é mencionado a ocorrência de 1113 espécies de basidiomycetes no estado, incluindo espécies com identificações duvidosas.

A partir de 2010 iniciou-se os estudos sobre a diversidade de macrofungos no oeste do Paraná, os quais têm revelado resultados significativos, incluindo relatos de novas ocorrências e descrição de novas espécies para a região (FERREIRA; CORTEZ, 2012; ALVES; CORTEZ, 2013a, 2013b; ALVES; CORTEZ, 2014; DIAS; CORTEZ, 2013; FERREIRA; WARTCHOW; CORTEZ, 2013; OLIVEIRA; CORTEZ 2016).

Observa-se que nos últimos anos, vem crescendo as pesquisas sobre os fungos *Agaricales* brasileiros ocorrentes na Floresta Atlântica s.l. (SILVA; CORTEZ; SILVEIRA, 2009; MENOLLI; CAPELARI, 2010; CAPELARI, 2011; CORTEZ; BASEIA; SILVEIRA, 2011; COIMBRA; GILBERTONI; WARTCHOW, 2013; KARSTEDT; CAPELARI, 2013; WARTCHOW; MAIA; CAVALCANTI, 2013a, 2013b), de modo que estima-se que ainda existam inúmeras espécies a serem descritas e registradas neste bioma.

A partir do modo como crescem as pesquisas sobre *Agaricales* brasileiros ocorrentes na Floresta Atlântica s.l., e de que existe uma estimativa que ainda existam inúmeras espécies a serem descritas e registradas neste bioma, o objetivo deste projeto consistiu em levantar dados da diversidade e distribuição de fungos *Agaricales* em dois remanescentes de Floresta Estacional Semidecidual no Oeste do Paraná, contribuir com informações de novos registros, a fim de entender melhor o processo de distribuição desses organismos, fomentar a coleção de macrofungos do herbário HCP, e atualizar dados junto a Lista de espécies da flora do Brasil (JBRJ-REFLORA).

2 MATERIAL E MÉTODOS

2.1 ÁREA DE ESTUDO

A maior parte do território do estado do Paraná está inserida no Bioma Mata Atlântica, onde três principais e diferentes tipologias florestais são encontradas: Floresta Ombrófila Densa, Floresta Ombrófila Mista e Floresta Estacional Semidecidual. Esta última representa ao formação florestal dominante nas regiões oeste, noroeste e norte do estado (RODERJAN et al., 2002, Figura 1).

Com características próprias, esse ecossistema está condicionado a um período de baixa precipitação, ou acentuada variação térmica, levando a uma modificação na fisionomia da sua vegetação (RODERJAN et al., 2002). Essas variações caracterizam a sazonalidade desse ecossistema, onde o estrato arbóreo superior perde suas folhas nos períodos desfavoráveis. Esse fenômeno é praticamente restrito aos estratos superiores e parece ter correlação principalmente com os parâmetros climáticos (LEITE, 2002). Na região oeste do Paraná essa sazonalidade está relacionada a um período de seca não bem estabelecido (KOZERA; PELUCI, 2015).

Para a realização deste estudo foram selecionados dois fragmentos de Floresta Estacional Semidecidual no oeste do Paraná. O Parque Estadual de São Camilo (PESC), localizado no município de Palotina, e a Reserva Particular do Patrimônio Natural Fazenda Açú (RFA), situada no município de Terra Roxa. Pela proximidade, ambas as áreas possuem basicamente a mesma composição florística. Na composição florística há dominância de gêneros amazônicos como *Parapiptadenia* Brenan*, Peltophorum* (Vogel) Benth., *Tabebuia* Gomes ex DC., *Astronium* Jacq., porém a espécie dominante é a peroba-rosa, *Aspidosperma polyneuron* Müll. Arg., além da marcante presença de *Fabaceae* Lindl., *Apocynaceae* Juss., *Meliaceae* Juss., *Euphorbiacace Juss.*, *Lauraceae,* Juss., *Arecaceae* Schultz Sch., *Myrtaceae* Juss. e *Rutaceae* Juss, além de numerosas lianas, representadas principalmente por espécies de *Bignoniaceae* Juss. (RODERJAN et al., 2002; KOZERA; PELUCI, 2015).

Foram selecionados cinco pontos de coleta no PESC, e quatro na RFA, (Figura 1), conforme características particulares de cada área de coleta. Essa organização em pontos de coletas facilitou o encontro de alguma espécie de

interesse e que podem futuramente possibilitar a recoleta. As coordenadas geográficas de cada um seguem dispostas na tabela 1. Espécies coprófilas foram coletadas em área de pastagem nas coordenadas de 24°18'17.75" S 53°54'7.98" O próximo a entrada PESC.

TABELA 1: LOCALIZAÇÃO GEOGRÁFICA DOS PONTOS DE COLETA DA RESERVA PARTICULAR DO PATRIMÔNIO NATURAL FAZENDA AÇÚ E DO PARQUE ESTADUAL DE SÃO CAMILO.

Estado	Município	Localidade	Ponto	Localização Geográfica	
PR	Terra Roxa	RPPN Fazenda Açu	1	24°11'55.47" S	53°57'39.88" O
			2	24°11'56.64" S	53°57'51.25" O
			3	24°11'57.22" S	53°57'58.27" O
			4	24°11'52.67" S	53°58'36.53" O
PR	Palotina	PESC	1	24°18'25.03" S	53°54'20.53" O
			2	24°18'24.39" S	53°54'21.83" O
			3	24°18'24.00" S	53°54'26.77" O
			4	24°18'26.60" S	53°54'24.00" O
			5	24°18'25.68" S	53°54'20.88" O

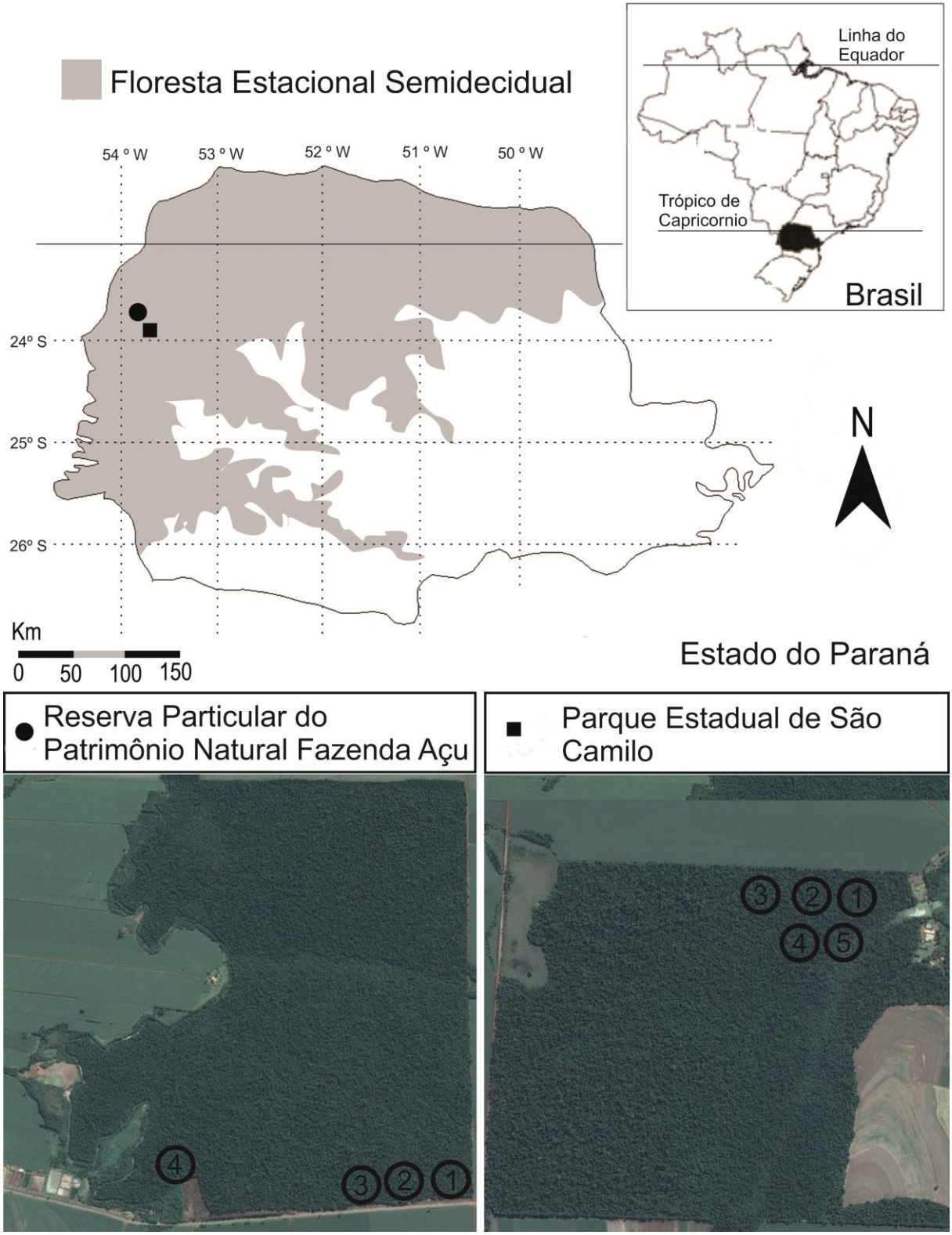
2.2 COLETA DE DADOS

Foram realizadas quarenta e uma coletas, durante 12 meses do projeto, Janeiro a Dezembro de 2015. As saídas tiveram duração média de três a quatro horas/dia, durante o período matutino, onde foram percorridas trilhas em diferentes pontos, como já mencionado. No PESC foram percorridos os 5 pontos de coleta por dia de coleta, já na RFA a busca ocorreu em apenas um ponto por dia de coleta. Ainda assim foram consideradas coletas previamente identificadas e depositadas no Herbário HCP entre os período de 2010 a 2014.

No momento da coleta foram anotados dados como número de coletor, parcela coletada e substrato. Os espécimes encontrados foram fotografados (com e sem escala métrica), utilizando câmera fotográfica digital Nikon Coolpix L120 e Nikon D3100.

Dependendo do tamanho dos basidiomas, estes foram acondicionados em caixas organizadoras e/ou sacos de papel, levados ao laboratório para realização de análises morfológicas (Figura 2).

FIGURA 1: LOCALIZAÇÃO E IMAGEM DE SATÉLITE DA RESERVA PARTICULAR DO PATRIMÔNIO NATURAL FAZENDA AÇÚ E DO PARQUE ESTADUAL DE SÃO CAMILO NO ESTADO DO PARANÁ, COM SEUS RESPECTIVOS PONTOS DE COLETAS.



FONTE: ALTERADO DE GOOGLE EARTH.

FIGURA 2: CAIXA ORGANIZADORA COM BASIDIOMAS COLETADOS E NUMERADOS.

FONTE: Alexandre Silva-Filho (2017)

2.3 PREPARAÇÃO, ANÁLISE E IDENTIFICAÇÃO DO MATERIAL COLETADO

Os espécimes coletados foram levados para o Laboratório de Taxonomia de Criptógamas e Fungos do Departamento de Biodiversidade do Setor Palotina, onde foram triados e processados de forma que todas as informações morfológicas necessárias para sua identificação fossem anotadas, passando por todos os processos descritos a seguir.

2.3.1 Obtenção da esporada

A esporada dos espécimes foi obtida com a retirada de uma porção do píleo, a qual foi colocada com as lamelas voltadas para baixo, sobre um pedaço de papel branco, coberto com uma placa petri e com algodão umedecido, formando assim uma câmara úmida (SINGER, 1986). Dependendo da espécie, ela pôde ser mantida

em entre 12 e 24 horas, porém espécimes mais frágeis permaneceram por poucas horas.

2.3.2 Análise Macroscópica

As análises macroscópicas foram realizadas logo após a coleta e contemplaram características fundamentais dos basidiomas, de acordo com os padrões morfológicos descritos detalhadamente por Largent (1986), e levaram em conta:

a) Basidioma: estatura (altura x largura), hábito e substrato;

b) Píleo: diâmetro, forma, superfície, cor, margem, espessura e coloração;

c) Contexto: tamanho, coloração e consistência;

d) Lamelas: forma, cor, abundância, inserção no estipe, margem e consistência;

e) Estipe: tamanho, posição, forma, cor, superfície, consistência e base.

As cores das macroestruturas foram designadas de acordo com a carta de cores de Kornerup e Wanscher (1978), incluindo o nome da cor originalmente em inglês, seguida do respectivo código. Todas essas informações foram anotadas em uma ficha de caracterização macromorfológica modificada de Pereira e Putzke (1990).

2.3.3 Análise Microscópica

As análises microscópicas foram realizadas através de secções dos basidiomas, preferencialmente frescos. Para reidratação e visualização de microestruturas, foram montadas lâminas com água destilada e hidróxido de potássio (KOH) a 3% (LARGENT; JOHNSON; WATLING, 1977). Foi utilizado o corante vermelho congo 1% para visualização de hifas e o reagente de Melzer foi utilizado para observação de reação amiloide de basidiósporos e hifas (LARGENT; JOHNSON; WATLING, 1977). Azul de algodão foi utilizado para verificar a reação cianofílica, em basídiósporos e basídios de certos gêneros (BARONI, 1981).

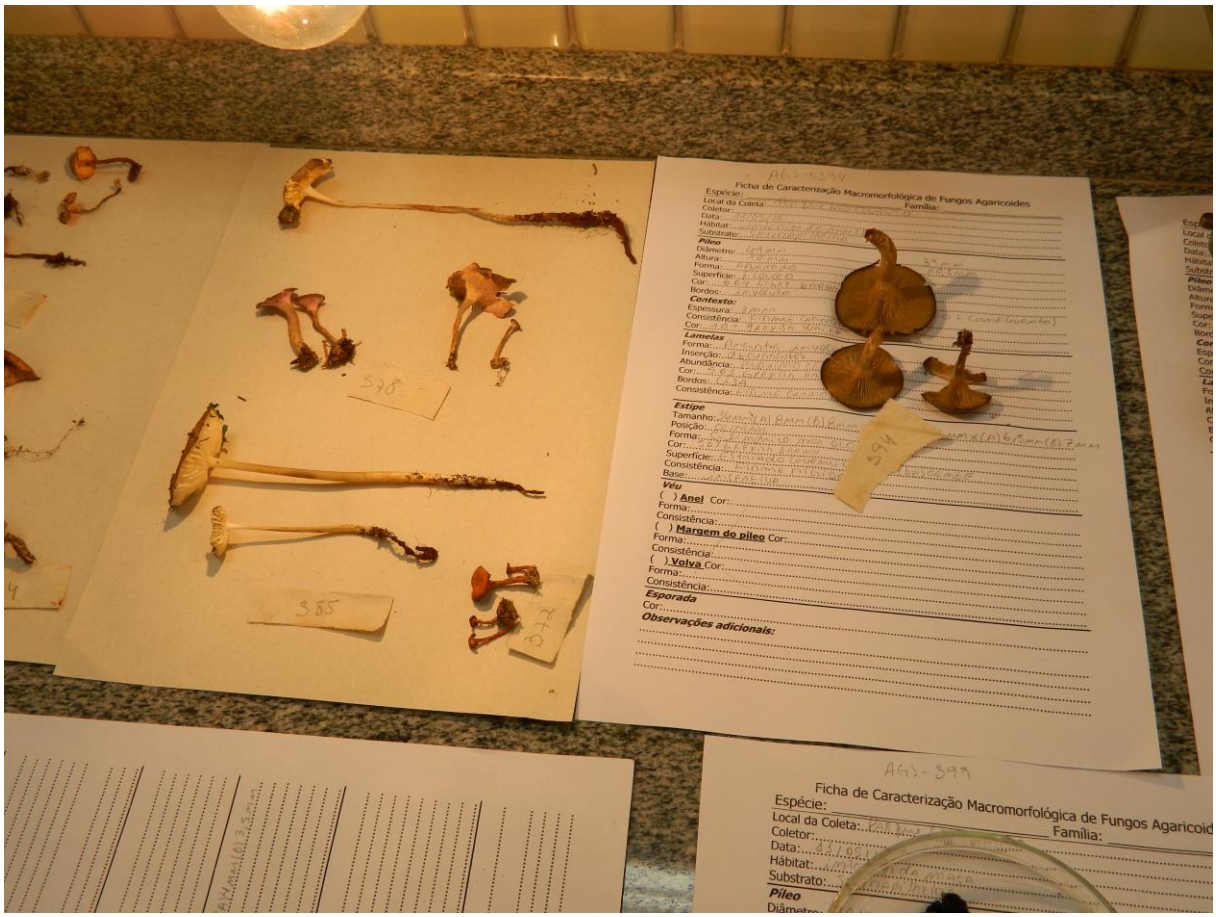
A descrição microscópica incluiu o formato da camada cortical do píleo; conformação das tramas da lamela, píleo e estipe; presença, forma e tamanho de elementos estéreis, como cistídios; forma, tamanho, superfície e detalhes da parede de basidiósporos; largura de hifas da pileipellis, contexto, trama da lamela e estipetipelis; ausência e presença de grampos de conexão (fíbulas).

As estruturas microscópicas foram fotografadas através de sistema de captura de imagens Toup Cam FMA050 adaptado ao microscópio óptico Olympus CX31 (Figura 5A).

2.3.4 Secagem e herborização

Após análise macroscópica, os espécimes foram conforme as dimensões e consistência dos basidioma, em estufa de secagem entreaberta a cerca de 35°C ou ainda em bancada na presença de uma lâmpada incandescente. A herborização se deu com a preservação do material coletado em papel alumínio e em envelopes para serem tombados no Herbário do Campus Palotina (HCP). No caso de espécies novas, os holótipos foram tombados no herbário UPCB, do Departamento de Botânica da UFPR.

FIGURA 3: BASIDIOMAS EM PROCESSO DE SECAGEM



FONTE: Alexandre Silva-Filho(2017)

2.3.5 Identificação dos espécimes

Após a realização das análises macro e micromofológicas, a identificação dos espécimes foi feita com auxílio de literatura especializada sobre o grupo. A classificação em nível de ordem e família está baseada em Hibbet et al. (2014). Para a identificação dos gêneros es espécies, foram utilizadas monografias especialmente Pegler (1983, 1997), Singer e Digilio (1951). Também foram consultados os bancos de dados *Index Fungorum* (www.indexfungorum.com) e *Mycobank* (www.mycobank.com).

Para conhecer e comparar dados da distribuição das espécies no Brasil e no estado do Paraná, foram utilizadas, respectivamente, a lista de fungos do Reflora (http://reflora.jbrj.gov.br/reflora/listaBrasil) Putzke (1994) e os *checklist* de de Meijer (2001, 2006, 2010).

2.3.6 Microscopia Eletrônica de Varredura

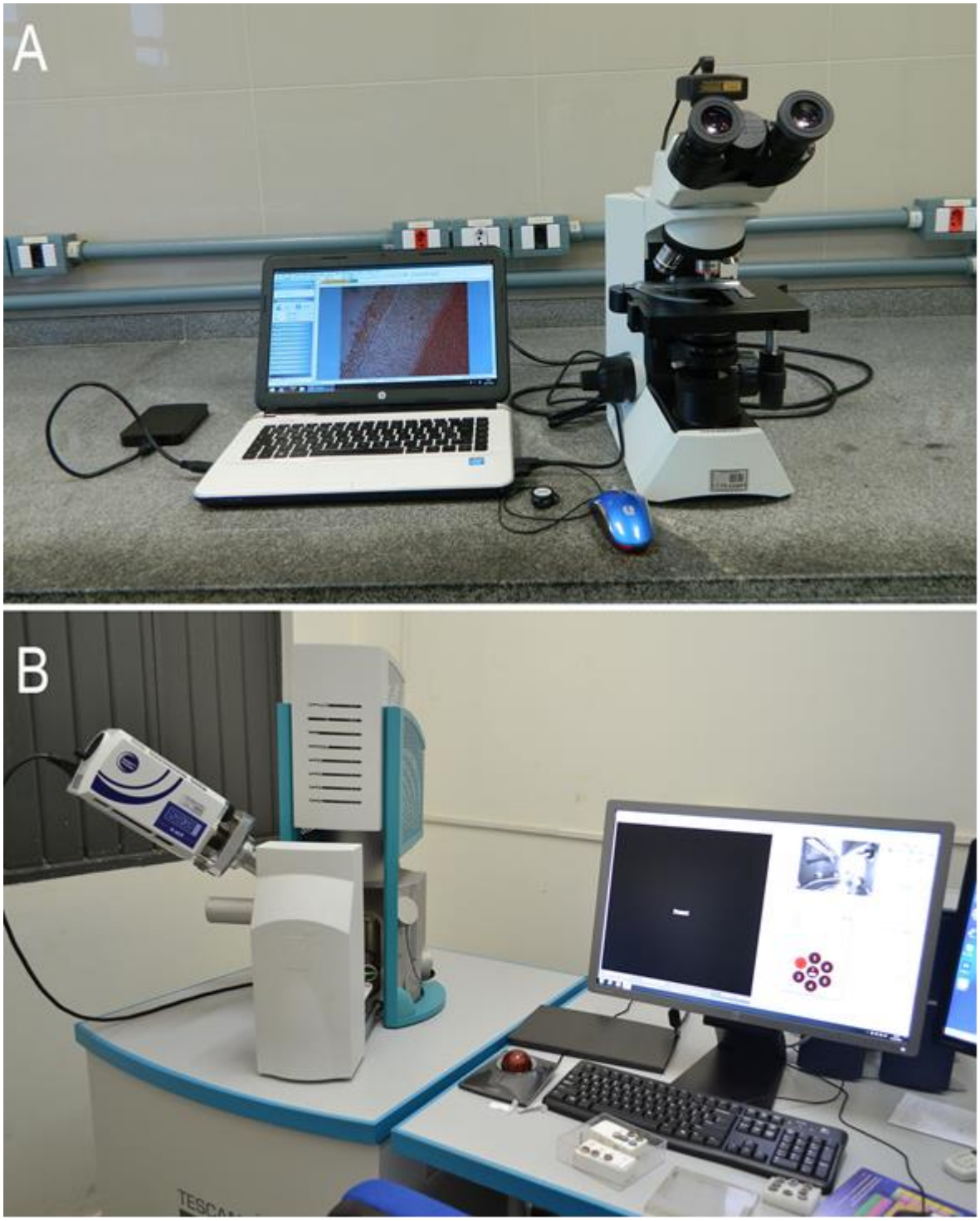
A análise por Microscopia Eletronica de Varredura foi realizada a fim de detalhar a morfologia de estruturas microscópicas dos basidiósporos com ornamentação, importantes na identificação de espécies. Para isto, uma porção da lamela foi destacada e fixada por fita adesiva de carbono em suportes de alumínio.

Alguns grupos com parede ornamentada e fina precisaram passar por um processo químico, no qual são reidratados, fixados e secos novamente. A metodologia foi a modificada de Baroni (1981): pequenas porções da lamela do espécime desidratado foram retiradas e lavadas por 2 a 5 minutos em KOH 5%. Em seguida, foram realizadas duas lavagens em água destilada por 2 a 5 minutos. As porções foram fixas em Tetróxido de Ósmio (OsO4) a 4% ou em solução de Glutaraldeído 1% e Formaldeído 4%, em Tampão Fosfato de Sódio 0,2M (MCDOWELL; TRUMP, 1976), por 8 a 24 horas. Após a fixação, as porções foram lavadas três vezes em água destilada e desidratadas em uma série gradual de álcool (10%, 30%, 50%, 70%, 90%, por 30 minutos cada, e três vezes 100%, por 15 minutos cada) para a troca em ponto crítico por CO2. Para este procedimento, os fragmentos foram montados entre papel-filtro, devido à fragilidade do material.

Os suportes com as amostras foram submetidos à metalização em metalizador Balzers SCD030 – Balzers Union FL9496, revestindo o material com uma camada de ouro. Finalmente, o material foi observado ao MEV Jeol JSM-6360LV (Figura 5B) sob tensão de 15-20 Kv, em magnificação variável (2.000-

30.000x,), com magnificação variável (2.000-30.000x), dependendo do tipo e do tamanho da microestrutura a ser examinada. As análises foram realizadas no Centro de Microscopia Eletrônica (CME) da UFPR, e no Laboratório de Microscópia Eletrônica de Varredura do Setor de Palotina.

FIGURA 4: A: MICROSCOPIA ÓPTICA COM SISTEMA DE CAPTURA. B: MICROSCOPIA ELETRÔNICA DE VARREDURA.



FONTE: Alexandre Silva-Filho (2017)

3 RESULTADOS

Das 41 expedições a campo, realizadas no ano de 2015, 636 amostras de fungos *Agaricales* foram coletadas. No total, 578 amostras foram consideradas nesta investigação. Outras, 58 foram descartadas em razão de terem sido danificadas ou deterioradas durante o processo de transporte, processamento e/ou herborização; em geral foram degradadas por larvas ou invertebrados adultos, eram muito frágeis e se degradam rapidamente, como algumas espécimes de *Coprinus* s.l., ou ainda não possuíam esporos para análise específica completa.

Desse total de 578 amostras, 76 espécies foram identificadas, em 49 gêneros de 16 diferentes famílias. Apenas 61 amostras não foram identificadas até família. *Agaricaceae* foi o grupo mais coletado seguido de *Mycenaceae Marasmiaceae*, e *Entolomataceae* (Tabela 2).

TABELA 2: NÚMERO DE ESPÉCIMES COLETADOS E ESPÉCIES IDENTIFICADOS POR FAMÍLIA.

Família	Amostras	Espécies
Agaricaceae Chevall.	118	17
Mycenaceae Overeem	86	7
Marasmiaceae Roze ex Kühner	84	8
Pluteaceae Kotl. & Pouzar	36	2
Entolomataceae Kotl. & Pouzar	41	5
Psathyrellaceae Vilgalys, Moncalvo & Redhead	37	7
Tricholomataceae Lotsy	34	9
Pleurotaceae Kühner	31	6
Physalacriaceae Corner	14	3
Crepidotaceae Singer	9	4
Hymenogastraceae Vittad.	8	2
Omphalotaceae Bresinsky	7	2
Hygrophoraceae Lotsy	4	1
Cortinariaceae R. Heim	5	1
Bolbitiaceae Singer	3	1
Tubariaceae vizzini	1	1
Não idenficados	60	
Total	578	76

São propostas apartir dessa pesquisa: *Clitocella pallescens* Silva-Filho & Cortez (Capítulo 3) *Panaeolus silvaticus* Silva-Filho, C. Seger, & Cortez (Capitulo 6)

como novas espécies para a ciência. Duas novas espécies de *Volvariella* Speg. coletadas durante esse período serão publicadas em um trabalho sobre o gênero em parceria com o mestrando Raphael Dias.

Espécimes de *Asproinocybe* R. Heim, e de *Tricholosporum* Guzmán, farão parte de um outro trabalho de filogenia do grupo em parceria com o Dr. Balint Dima da Helsinki University, Hungria. Entre os resultados prévios deste trabalho, está uma nova espécie de *Asproinocybe* e outra de *Tricholosporum*, confirmadas a partir de dados moleculares e morfológicos. Esses dois gêneros também eram desconhecidos para a América do Sul.

Quanto à distribuição, *Copelandia mexicana* Guzmán, *Crepidotus mexicanus* Singer, *Tricholosporum tropicalis* Guzmán, Bandala & Montoya *e Tubaria bispora* Matheny, P.-A. Moreau, M.A. Neves & Vellinga, antes reportada apenas na America central, tem sua distribuição expandida para a América do Sul. O gênero *Clitocella* é citado pela primeira vez no Brasil. Outras seis espécies também tem sua distribuição ampliada para o Brasil (Tabela 3), nove para o Estado do Paraná (Tabela 4) e 27 são novas ocorrências para Floresta Estacional Semidecidual do estado do Paraná (Tabelas 5).

TABELA 3: LISTA DE NOVAS OCORRÊNCIAS PARA O BRASIL.

Primeiro registro para o Brasil
Agaricus ochraceosquamulosus Heinem
Clitocella himantiigena (Speg.) Silva-Filho & Cortez
Gymnopilus chrysopellus (Berk. & M.A. Curtis) Murrill
Leucoagaricus coerulescens (Peck) J.F. Liang, Zhu L. Yang & J. Xu
Marasmiellus atrosetosus Dennis
Rhodocybe galerinoides Singer

As 17 espécies identificadas como “sp.” também podem representar novidades taxonômicas e merecem mais atenção e investigação, e/ou também precisam de novas coletas para a correta conclusão de suas respectivas posições taxonômicas.

Os resultados obtidos são apresentados em forma de capítulos. Um primeiro artigo já foi publicado (Capítulo 1), um segundo foi submetido e aguarda revisão (Capítulo 2), outros cinco serão submetidos como apresentados a seguir:

TABELA 4: LISTA DE NOVAS OCORRÊNCIAS PARA O ESTADO DO PARANÁ.

Primeiro registro para o estado do Paraná
Agaricus endoxanthus Berk. & Broome
Crepidotus crocophyllus (Berk.) Sacc.
Hohenbuehelia mastrucata (Fr.) Singer
Lepiota lilacea Bres.
Leucocoprinus straminellus (Bagl.) Narducci & Caroti
Mycena euspeirea (Berk. & M.A. Curtis) Sacc.
Mycena holoporphyra (Berk. & M.A. Curtis) Singer
Pleurotus opuntiae (Durieu & Lév.) Sacc.
Psilocybe yungensis Singer & A.H. Sm

TABELA 5: LISTA DE NOVAS OCORRENCIAS EM FLORESTA ESTACIONAL SEMIDECIDUAL DO PARANÁ.

Primeiro registro para F.E.S. do Estado do Paraná
Agaricus purpurellus F.H. Møller
Agaricus volvatulus Heinem. & Gooss.-Font.
Conocybe reticulatorugosa Singer
Copelandia cyanescens (Berk. & Br.) Singer
Coprinellus disseminatus (Pers.) J.E. Lange
Crinipellis commixta var. commixta Singer
Crinipellis eggersii var. epiphyllus Singer
Dennisiomyces glabrescentipes Singer
Dennisiomyces rionegrensis Singer
Galerina physospora Singer
Hohenbuehelia angustata (Berk.) Singer
Hohenbuehelia bullulifera Singer
Hohenbuehelia paraguayensis (Speg.) Singer
Hygrocybe conica (Schaeff.) P. Kumm
Hymenopellis radicata (Konrad & Maubl.) Bon & Dennis
Lepiota guatopoensis Dennis
Lepista sordida (Schumach.) Singer
Marasmiellus distantifolius (Murrill) Singer
Marasmius graminum var. schini Singer
Marasmius haematocephalus (Mont.) Fr.
Marasmius isabellinus Pat.
Mycena cloroxantha (Fr.) P. Kumm.
Neopaxillus echinospermus (Speg.) Singer
Panaeolus antillarum (Fr.) Dennis
Panaeolus papilionaceus (Bull.) Quél.
Panellus pusillus (Pers. ex Lév.) Burds. & O.K. Mill.
Xeromphalina tenuipes (Schwein.) A.H. Sm.

CAPÍTULO 1**: Further notes on the morphology and distribution of *Neopaxillus echinospermus* in Southern Brazil**

Este artigo foi submetido (03/07/2015), aceito (15/12/2015) e publicado (28/01/2016) na revista *Checklist,* Brasil (Qualis B3 - Biodiversidade). Uma descrição da espécie foi feita, assim como comentários morfológicos, taxonômicos e de distribuição da espécie. Imagens micro e macromorfológicas assim como de MEV, foram disponibilizadas.

CAPÍTULO 2**: The Neurotropic mushroom *Copelandia* (*Basidiomycota*) in western Paraná state, Brazil**

Este artigo foi submetido (30/10/2016) à Revista Mexicana de Biodiversidad, México (Qualis B3). Duas espécies são descritas em detalhes e comentadas. *Copelandia mexicana*, é registrada pela primeira vez na América do Sul. Pranchas com imagens micro e macromorfológicas foram disponibilizadas. O texto segue a formatação recomendada pelas normas da revista, disponível em:
http://revista.ib.unam.mx/index.php/bio/about/submissions#author Guidelines

CAPÍTULO 3**: *Rhodocybe* and *Clitocella* (*Entolomataceae*) from western Paraná State, Brazil**

Este artigo será submetido à Revista Darwiniana, Argentina (Qualis B3) onde quatro espécies são descritas e comentadas. *Clitocella*, passa a ser conhecido para o Brasil. *Clitocella pallescens* é proposta como novo táxon apartir de dados morfológicos. *Clitocella himantiigena* é proposta como nova combinação e juntamente com *Rhodocybe galerinoides* são novos registros para o Brasil. Todas as espécies possuem imagens micro e macromorfológicas assim como MEV dos basidiosporos. O texto segue a formatação recomendada pelas normas da revista, disponível em:
http://www.ojs.darwin.edu.ar/index.php/darwiniana/about/submissions#authorGuidelines

CAPÍTULO 4**: *Hohenbuehelia* (*Pleurotaceae*) from Seasonal Semidecidual Forest of Paraná State, Brazil**

Este artigo será submetido à revista Acta Biológica Paranaense, Brazil (Qualis C). Cinco espécies de *Hohenbuehelia* são descritas apartir de coletas em Floresta

Estacional Semidecidual no Oeste do Paraná. *Hohenbuehelia mastrucata* representa novo registro para o estado do Paraná. *H. angustata, H. bullulifera* e *H. paraguayensis* são novos registros para FES. *Hohenbuehelia portegna*, também é descrita e ilustrada e discutida. O texto segue as normas da revista, disponíveis em: http://revistas.ufpr.br/acta/about/submissions#onlineSubmissions

CAPÍTULO 5**: *Crepidotus* and *Simocybe* (*Agaricales*) from Seasonal Semidecidual Forests of Paraná State, Brazil**

Este artigo será submetido à revista Rodriguésia, Brasil (Qualis B3.) Duas espécies de *Crepidotus*, e uma de *Simocybe* são descritas em detalhe. *Crepidotus mexicanus* é uma espécie rara e esse é o segundo registro dele para a ciência e a primeira para a América do Sul. *Crepidotus crocophyllus* é o primeiro registro para o estado do paraná. A formatação segue as normas da revista, disponível no endereço eletrônico: http://rodriguesia.jbrj.gov.br/.

CAPÍTULO 6**: *Panaeolus* (*Agaricales*) from the western Paraná State, south Brazil, with a description of a new species: *Panaeolus silvaticus***

Este artigo será submetido à revista Kew Bulletin, Inglaterra (Qualis B2). Nele é proposta uma nova espécie para o gênero, *Panaeolus silvaticus,* e outras duas espécies coprófilas, *Panaeolus antillarum* e *Panaeolus papilionaceus,* são descritas e ilustradas em detalhe. A formatação segue as normas da revista, disponível no endereço eletrônico: http://www.kew.org/publications/kewbulletin.html.

CAPÍTULO 7**: Annoted check list of *Agaricales* s.l. from Seasonal Semidecidual Forest from Paraná State, Brazil.**

Este artigo será submetido à revista Mycotaxon, Estados Unidos (Qualis B2). É apresentado nesse manuscrito uma lista com as espécies de *Agaricales* coletados em 2015 com adição de espécies coletadas identificadas e depositadas no Herbário HCP desde 2010. A formatação segue as normas da revista, disponível no endereço eletrônico: http://www.mycotaxon.com/instructions.html

4 CAPITULO 1:

Artigo publicado na revista *Check list* (Qualis B3 - Biodiversidade) .

Check List the journal of biodiversity data

NOTES ON GEOGRAPHIC DISTRIBUTION

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Further notes on the morphology and distribution of *Neopaxillus echinospermus* (Agaricales, Basidiomycota) in Southern Brazil

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Abstract: *Neopaxillus echinospermus* is a common but poorly understood agaric species from South America (Argentina, Bolivia, Brazil and Paraguay). In this paper, we discuss conflicting morphological features reported in the literature and expand the distribution of the species to Seasonal Deciduous and Semideciduous Forests from Rio Grande do Sul and Paraná states, respectively, in Southern Brazil. Hyphal structure of the pileipellis, presence of cheilocystidia and caulocystidia, presence of clamp connections and oleiferous (thrombopleurous) hyphae, and the basidiospore morphology under scanning electron microscopy are illustrated and discussed in detail.

Key words: boletoid; Crepidotaceae; Seasonal Forest; Neotropical fungus; Paxillaceae

Neopaxillus echinospermus (Speg.) Singer is a mushroom species, with a limited and poorly documented distribution in South America, comprising Argentina, Brazil, Paraguay and Bolivia (Watling and de Meijer 1997). This agaric was originally described by Singer (1948) as *Neopaxillus echinosporus* Singer, based on specimens collected by J. Rick supposedly in Rio Grande do Sul, in Southern Brazil. This name was put into synonymy based on further examination of *Naucoria echinosperma* Speg. from Brazil (Spegazzini 1889), which was considered the correct basionym of the species; for a detailed nomenclatural discussion, see Watling and Aime (2013).

For many years, *Neopaxillus* Singer remained as a monotypic genus in the Crepidotaceae (Imai) Singer, until Singer and Lodge (1988) described *N. plumbeus* from Costa Rica, Central America. Based on both macro- and micromorphological similarities, some researchers suggested that the genus would be related to the gilled boletes, proposing its placement in the Paxillaceae Lotsy (Singer 1986) or Serpulaceae Jarosch & Bresinsky (Binder and Hibbett 2006). Recently, Vizzini et al. (2012) described *N. dominicanus* from Central America and their phylogenetic resulted in the return of *Neopaxillus* to the Crepidotaceae. Finally, Watling and Aime (2013) analyzed morphology and 28s ribosomal DNA region of *N. echinospermus* and reassured the position of the type species in the latter family.

In spite of the current and relatively consistent position of the genus, supported on molecular analysis, conflicting morphological data have been noted in the literature, such as the absence or presence of cystidia and clamp connections, and the hyphal structure of the pileipellis.

Thus, the aim of this paper is to provide modern and detailed descriptions of *N. echinospermus*, updating the morphological concept of the species, based on collections from Atlantic Forest in Southern Brazil, and to expand the known distribution of the fungus in Seasonal Semideciduous and Deciduous Forests of that biome.

Samples were collected, during recent fieldwork in Seasonal Semideciduous Forest from the western region of Paraná state, and previous collections in Seasonal Deciduous Forests from central region of Rio Grande do Sul state. These ecosystems are two common vegetation types in the Atlantic Forest biome of Southern Brazil, in which a portion of the trees defoliates during the dry season (IBGE 2012). Moreover, these forests are characterized by the presence of tree species of Anacardiaceae, Apocynaceae, Bignoniaceae, Boraginaceae, Caricaceae, Fabaceae, Malvaceae, Meliaceae, Moraceae, Rutaceae and Sapindaceae (Roderjan et al. 2002).

Morphological analysis (both macro- and microscopical) followed standard procedures for agaricoid fungi (Singer 1986). Color names and codes adopted in the macroscopic features are from Kornerup and Wanscher

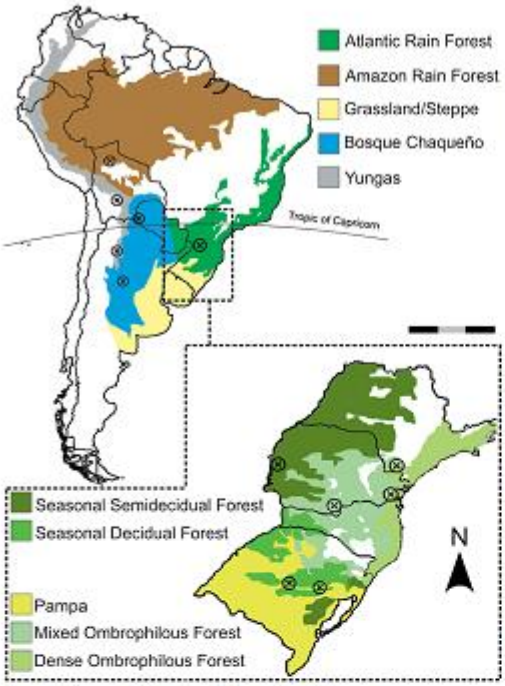


Figure 1. Known distribution of *Neopaxillus echinospermus*.

(1978). Micrographs were made from a Motic BA310 light microscope with a Moticam 2500 digital camera, and measurements were taken through software Motic Image Plus 2.0. In the basidiospores description Q is the quotient between the length and width, Qm is the medium value of Q, and n is the number of measured basidiospores/number of analyzed basidiomata/number of collections. Scanning electron micrographs (SEM) were performed at the Center of Electron Microscopy of the Federal University of Paraná at Curitiba (CME/UFPR), under a Jeol JSM-6360LV scanning electron microscope. Examined specimens are preserved at the herbaria HCP (Universidade Federal do Paraná, Campus Palotina) and HCB (Universidade de Santa Cruz do Sul, Departamento de Biologia e Farmácia).

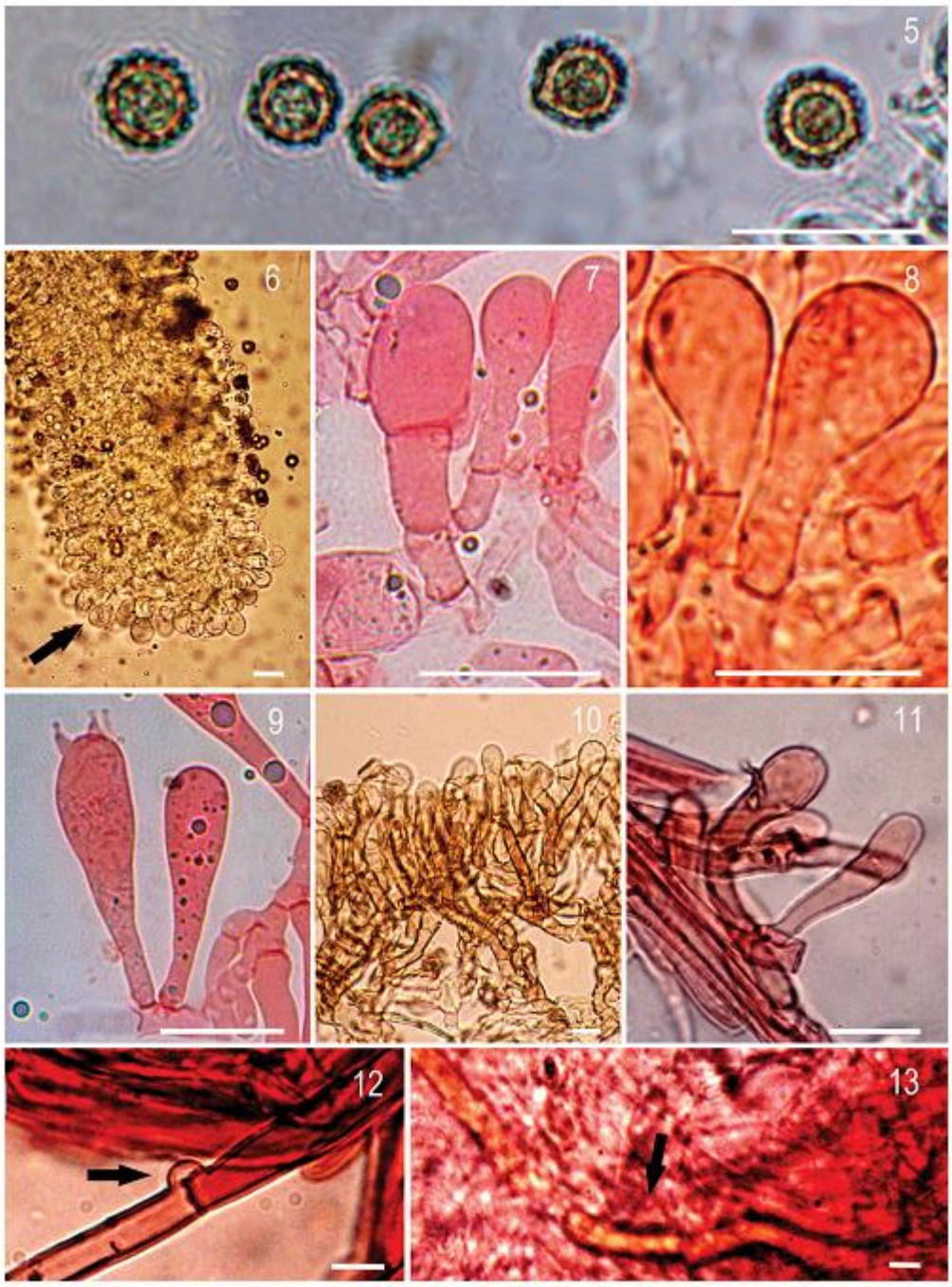
Neopaxillus echinospermus (Speg.) Singer, Lilloa 22: 633, 1951 ("1949"). Figures 2–15

≡ *Naucoria echinosperma* Speg., Bol. Acad. Nac. Cienc. Cordoba 11: 424, 1889.

– *Neopaxillus echinosporus* Singer, Mycologia 40: 262, 1948.

Basidiomata agaricoid, omphalinoid. Pileus 12–36 × 9–34 mm diam., infundibuliform, plano-depressed or applanate, surface dry and smooth, hygrophanous, yellowish brown (5D8) golden brown (5D7), greyish yellow (4C6) to reddish orange (7A8) when fresh (Figure 3–4),

Figures 2–4. Basidiomata of *Neopaxillus echinospermus* (**2**, HCP 713, photo by G. Coelho; **3**, HCP 704 photo by A. Silva-Filho; **4**, HCP 706 photo by A. Silva-Filho). Scale bar = 25 mm.

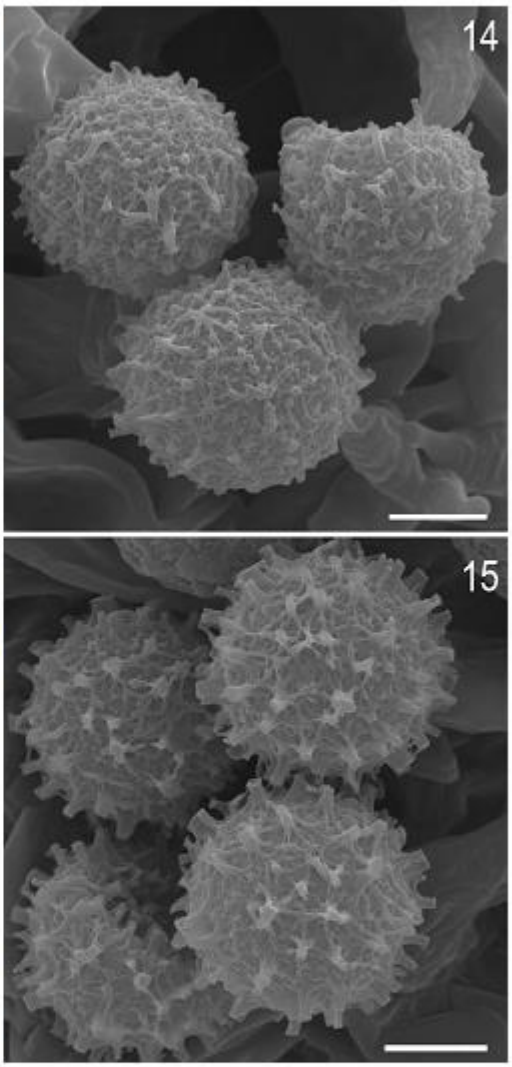


Figures 5–13. Microscopic features of *Neopaxillus echinospermus*. **5:** Basidiospores (under KOH). **6:** Section of lamella exhibiting crowded cheilocystidia (KOH). **7:** Catenulate cheilocystidia (Congo red). **8:** Cheilocystidia (Congo red). **9:** Basidium (Congo red). **10:** Pileipellis hyphae (KOH). **11:** Caulocystidia (Congo red). **12:** Clamp connection (Congo red). **13:** Oleiferous hyphae from stipe trama (Congo red). All photos by A. Silva-Filho (5,6,8,10 from HCP 705; 7,9,11,12,13 from HCP 704). Scale bar =20 µm.

becoming yellowish brown (5D5–5E8) when dry, margin incurved to plane, even, slightly undulate or lobate, non-striate. Lamellae decurrent to arcuate, subdistant with lamellulae of three lengths (Figure 2), margin straight, smooth to slightly crenulate, concolorous with sides, white (1A1), yellowish white (1A2) when young, becoming light brown (5D6) at maturity, membranous slightly fleshy. Stipe 20–39 × 2–3.5 mm (base), 2.5–7 mm (apex), central, cylindrical to slightly tapered, with base clavate to sub-bulbous, smooth to slightly striate, yellowish white (1A2) with pale yellow (1A3) to brownish orange (5C3) spots, context solid, becoming hollow at maturity. Rhizomorphs absent, but in young specimens a scanty basal mycelium can be observed. Context confluent, white (1A1) when fresh and young to yellowish white (1A2) in age or when sectioned, fleshy and soft, up to 5 mm thick. Spore print brown (6E8).

Basidiospores 6.5–9 × 6.5–8.5 µm (excluding ornamentation), Q= 1.05–1.38, Q_m= 1.13, n= 70/4/4, subglobose to globose, echinulate to warty, thick-walled, pale brown, inamyloid, commonly containing a large oil drop (Figure 5); the ornamentation is composed of short warts when younger, then distinctly spiny when fully mature, measuring 0.5–0.9 µm; under SEM, the ornamentation is composed of a densely reticulate background, from which arise columnar spines with flattened tips (Figure 15). Basidia 28.5–52 × 7.5–11 µm, narrow clavate to clavate, with four (Figure 9), rarely two sterigmata, hyaline to pale yellowish. Pleurocystidia absent. Cheilocystidia 18.5–32 (–44.5) × 6.5–16 µm, numerous and crowded, becoming the gill edge sterile (Figure 6), clavate, pyriform or sphaeropedunculate, a few lageniform, cylindrical to catenulate, sometimes with a short pedicel, hyaline to pale yellowish (Figures 7 and 8). Pileipellis composed of two layers: hymeniform suprapellis, composed of cylindrical, clavate with rounded apex, sometimes subcapitate elements, 33.5–49 × 6.7–10 µm, slightly incrusted (Figure 10), pale brown and dextrinoid; subpellis composed of radially arranged filamentous hyphae, walls thin, slightly incrusted or smooth, pale brown, 3–5.7 µm wide. Pileus trama of radially arranged hyphae, 3.4–8 µm diam., hyaline. Lamella trama subregular, formed of filamentous and narrow to slightly inflated hyphae, hyaline, 3.5–7 µm wide. Subhymenium composed of hyaline thin hyphae, 2–2.5 µm diam. Stipitipellis composed of smooth, hyaline and slightly incrusted hyphae, 2.8–7.3 µm wide, bearing bunches of caulocystidia. Caulocystidia 27–56 × 5–14 µm, in fascicles on stipe surface, cylindrical, clavate (Figure 11) and sphaeropendiculate, thin-walled and hyaline. Oleiferous (thrombopleurous) hyphae (Figure 13) observed in the pileus, lamella trama, and stipe tissue. Clamp connections present in all septa (Figure 12).

Habitat: In the forest, terricolous, among litterfall, solitary to gregarious or subcaespitose, in small clusters, on bare soil.



Figures 14 and 15. SEM micrographs of the basidiospores of *Neopaxillus echinospermus* (HCP 704). **14:** Basidiospores with partially developed ornamentation. **15:** Mature basidiospores with a fully developed ornamentation. Scale bar =2 µm.

Known distribution: In tropical (Amazon Rain Forest and Yungas, Bolivia) and subtropical (Bosque Chaqueño and Yungas in Argentina, Bosque Chaqueño in Paraguay, Atlantic Forest in Brazil) regions of South America (Singer 1964). In Brazil, it has been reported only for Dense Ombrophilous Forests and Mixed Ombrophilous Forest in São Paulo and Paraná states (de Meijer 2008; Watling and de Meijer 1997). The probable type locality of *N. echinosporus*, as discussed later, is within the Pampa

biome of Brazil. It is the first record of the species from the Seasonal Deciduous and Semideciduous Forests. Figure 1 presents the known distribution of the species.

Examined specimens: BRAZIL. PARANÁ: Palotina: Parque Estadual São Camilo, 19/V/2010, Ferreira A. J. & Souza D. (HCP 339); *ibid*, 02/III/2015, Silva-Filho AGS-189 (HCP 707); *ibid*, 27/IV2015, Silva-Filho AGS-337 (HCP 708); *ibid*, 15/VI/2015, Silva-Filho AGS-482 (HCP 709); Terra Roxa: RPPN: Fazenda Açú, 24/II/2015, Silva-Filho AGS-141 (HCP 704); *ibid*, Silva-Filho AGS-144 (HCP 705); *ibid*, Silva-Filho AGS-150 (HCP 706). RIO GRANDE DO SUL: Itaara: Parque Pinhal, 04/V/2007, V.G. Cortez 082/07 (HCP 710); Santa Cruz do Sul: UNISC, 13/III/1996, M.A. Sulzbacher 167 (HCB 16676); Santa Maria: Morro Mariano da Rocha, 23/III/2007, V.G. Cortez 028/07 (HCP 711); Três Barras, 14/03/2008, V.G. Cortez 052/08(HCP 712); and 063/08 (HCP 713).

The literature presents some controversial morphological data on *Neopaxillus echinospermus*. In the original description, Singer (1948) described the species as without cystidia, but with cystidioles on the gill margin, clamp connections in all septa, and pileipellis composed of a trichoderm-palisade. On the other hand, Watling and de Meijer (1997) and Watling and Aime (2013) reported specimens from Paraná state without any type of cystidia, absence of clamp connections, and pileipellis formed of filamentous, somewhat incrusted, and irregularly arranged hyphae. De Meijer (2008) presented a detailed description and illustrations of *N. echinospermus* and, in agreement to our examined material, he described the presence of both cheilocystidia and clamp connections. Vizzini et al. (2012), on discussing *N. dominicanus* Angelini & Vizzini, also examined specimens of *N. echinospermus* from Paraná (collected by A.A.R de Meijer) and not only observed cheilocystidia but also inconspicuous pleurocystidia, which we have not found in our materials.

All examined samples from Paraná and Rio Grande do Sul exhibited conspicuous clamp connections (Figure 13) and cheilocystidia (Figures 6–8), with variable morphology, including presence of catenulate cheilocystidia (Figure 7); the pileipellis of these mushrooms also presented the same trichoderm-palisadoderm pattern described by Singer (1948), which is mainly composed of clavate or (sub-) cylindrical elements. It is probable that older specimens can be more difficult to note the presence and position of such structures, but when fresh collections are examined they are conspicuous. In addition, we also noted the presence of oleiferous (thrombopleurous) hyphae in all parts of the basidiomata (Figure 13), a feature only mentioned in the recently described *N. dominicanus* (Vizzini et al. 2012). The great variation on the color of pileus is also illustrated here (Figures 3 and 4), however this feature alone is of poor taxonomic value, since the basidiomata persist for several days and are subject to numerous environmental factors that change the basidiomata colors.

The probable mycorrhizal status of this mushroom is to be determined, since the genus was considered in the past close to Paxillaceae and Cortinariaceae, two families with numerous ectomycorrhizal genera. Our field observations suggest that this species would not be a mycorrhizal fungus, because when the basidiomata are carefully removed from the substrate, we have not noticed the presence of rhizomorphs or other morphological evidences of this partnership. No molecular or culture studies were performed to determine (or not) the mycorrhizal status in *Neopaxillus* members, but as previously pointed, the absence of typical plant partners in this part of Atlantic Forests, as well the current placement of the species in the non-mycorrhizal family Crepidotaceae are strong evidences suggesting saprotrophic condition (Aime et al. 2005; Vizzini et al. 2012; Watling and Aime 2013).

Neopaxillus echinospermus is known from South American tropics and subtropical regions (Argentina, Paraguay, Bolivia, and Southern and Southeastern Brazil); reports from Central America and México were considered by Vizzini et al. (2012) as misidentifications of *N. dominicanus*. In Brazil, the species has been previously reported from Ombrophilous Forests, especially the Mixed Ombrophilous Forest from Southern (de Meijer 2008, from Paraná) and Dense Ombrophilous Forest in Southeastern (Spegazzini 1889, from São Paulo). The type locality of *N. echinosporus* (Singer 1948) is not precise; the material was collected by J. Rick in a place called Couto which, according to Watling and de Meijer (1997), may to represent a locality near the municipality of Rio Pardo in the central region Rio Grande do Sul state. If correct, this area belongs to the Pampa biome of southern Brazil, and comprises swampy and grassland vegetation, composed mainly of native grasses, with tree vegetation found only of riparian forest (Silva et al. 2011). With the new findings, the distribution of this species is now expanded to the Seasonal Semideciduous Forests from the state of Paraná and Seasonal Deciduous Forests of Rio Grande do Sul state, both in Southern Brazil. New reports of *N. echinospermus* are expected from other areas of Central Brazil and South America, requiring future mycological fieldwork on these areas.

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Author contributions: AGSS-F collected the samples, described the morphological characteristics of the specimens, took the photos, and produced the figures and map. GC and VGC, collected and identified samples, contributed to the introduction, discussion, literature and article review.

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5 Capitulo 2: Artigo submetido a Revista Mexicana de Biodiversidad

Silva-Filho et al. The neurotropic mushroom *Copelandia* in western Paraná State

The neurotropic mushroom *Copelandia* (Basidiomycota) in western Paraná State, Brazil

El hongo neurotrópico *Copelandia* (Basidiomycota) en oeste del estado de Paraná, Brasil

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ABSTRACT:

In a survey of the agaricoid fungi from the western region of Paraná State, south Brazil, two species of *Copelandia* were identified. *Copelandia cyanescens* is a common and widely distributed coprophilous species with typical bluing reaction. *Copelandia mexicana*, is a rare and poorly known mushroom, lignicolous and not conspicuously bluing, with distinct macro- and micromorphological features, is a new record from South America. Both species are described and illustrated in detail, and discussed regarding distribution, taxonomy and nomenclature.

KEY WORDS: Agaricales, Brazilian fungi, dark-spored fungi, hallucinogenic mushroom, Psathyrellaceae

RESUMEN

En un estudio de los hongos agaricales de la región occidental del estado de Paraná, sur de Brasil, se identificaron dos especies de *Copelandia*. *Copelandia cyanescens* es una especie coprófila común y ampliamente distribuida, además de una típica reacción azulada. *Copelandia mexicana*, un hongo raro y poco conocido, además de ser lignícola e con una incosnpicua reacción azulada, presenta distintas características macro y micromorfológicas. Esta especie es un nuevo registro para América del Sur. Ambas especies se describen e ilustran en detalle, y discutidas sobre distribución, taxonomía y nomenclatura.

PALABRAS CLAVE: Agaricales, hongos del Brasil, hongos esporada oscura, hongo alucinógeno,psathyrellaceae

INTRODUCTION

The genus *Copelandia* was proposed by Bresadola (1913) to accommodate *Panaeolus* (Fr.) Quél. species presenting metuloidal pleurocystidia. The bluing reaction of the basidiomata – a common feature in most species – is indicative of the presence of psilocin, as well other psychoactive compounds, which renders to these species the status as hallucinogenic (Guzmán et al., 2000; Singer, 1986). The strong morphological similarities with *Panaeolus* led some authors to recognize *Copelandia* as synonym of the former genus (Gerhardt, 1996; Ola’h, 1969), although most authors consider it as an autonomous genus (Singer, 1986; Watling and Gregory, 1987). The genus comprises about ten species (Guzmán et al., 2000), of which *C. cambodginiensis* (Ola'h & R. Heim) Singer & R.A. Weeks (as *Panaeolus cambodginiensis* Ola'h & R. Heim) *C. cyanescens* (Berk. & Broome) Singer and *C. tropicalis* (Ola'h) Singer & R.A. Weeks (as *Panaeolus* aff. *tropicalis* Ola'h), are known in Brazil (de Meijer, 2006; Wartchow et al., 2010).

During an investigation of the agaricoid fungi in seasonal semideciduous forest (Oliveira and Cortez, 2016; Silva-Filho et al., 2016) in western region of Paraná State, south

Brazil, we examined collections belonging to *Copelandia*, which are described, illustrated and discussed as follows.

MATERIALS & METHODS

Specimens were collected in two localities, comprising fragments of Seasonal Semidecidual Forest (Atlantic Forest Biome) in the western region of Paraná State: RPPN Fazenda Açu, municipality of Terra Roxa, and PE de São Camilo, municipality of Palotina. Morphological analysis (both macro- and microscopical) followed standard procedures for agaricoid fungi Singer (1986). Colour names and codes used in the macroscopical descriptions are based on Kornerup and Wanscher (1978). In the basidiospores description, Q is the quotient between the length and width, Qm is the medium value of Q and n is the number of measured basidiospores/number of analyzed basidiomata/number of collections. Microscopic measurements and photographs were made under an Olympus CX31 optical microscope with a Toup Cam FMA050 digital camera, and measurements were taken through software Toup tek Toup View. All specimens were dried in an open air drier (±40ºC) and are preserved at the mycological collection of the Herbarium of Universidade Federal do Paraná (HCP).

DESCRIPTION

Copelandia cyanescens (Berk. & Broome) Singer, Lilloa 22: 473 (1951) Figure (1, 2, 6-10)

≡ *Panaeolus cyanescens* (Berk. & Broome) Sacc., Syll. Fung. 5: 1123 (1887)

Pileus 22–56 mm diam., broadly parabolic, convex, to broadly-convex, surface smooth, hygrophanous, yellowish-white (1A2) with light yellow (1A5) at the center, making bluish grey (23C3) to dark blue (25F4) when wounded and touched, margin non striated, acute to slightly reflexed (Fig 1). Lamellae adnate, crowded, with 2 lamelullae, edge smooth to slightly crenate, discolor paler with the sides, consistency fleshy, medium grey (1E1) to grey (1D1) with spots (Fig. 2). Stipe 48–110 × 2–6 mm, central, cylindrical, equal to slightly bulbous at base,

fistulose, surface smooth to slightly fibrillose, slightly velutinous near the apex, consistency fleshy, with white mycelial pad in some specimens, yellowish white (1A2) to yellowish grey (2C2) at apex, brownish grey (4D2, 5C2) at base, making bluish when touched as the pileus. Context two layered: the upper layer 1.5–2 mm thickness, yellowish with (1A1), and the lower layer 1.5–2 mm thickness, olive grey (1E2), fleshy. Veil absent. Spore print dark grey (1F1).

Basidiospores 11.5–14.5 × 9–11 µm (Q=1.13–1.48, Qm= 1.28, n=30/1/3), limoniform in face-view, ellipsoidal in side-view, apically truncate by a germ-pore, thick-walled, reddish brown to black in KOH, not bleaching in 95–98% sulfuric acid (Fig. 6). Basidia 17–22.5 × 9–12.5 µm, broadly clavate to cylindro-clavate, hyaline, tetrasporic. Pleurocystidia 33.5–68 × 15–25 µm, as metuloids, abundant, pedicellate-utriform, broadly-fusiform, with acuminate and incrusted apex (muricate), thick-walled, ≥1.5 µm, light brown with brown wall and greenish apex in KOH (Fig. 7). Cheilocystidia 21–37 × 7–14 µm, abundant, lageniform, obpyriform, some sphaeropedunculate, slightly thickened, hyaline in KOH (Fig. 8). Lamella edge sterile. Lamella trama irregular, with filamentous to inflated hyphae 5–20.5 µm diam., smooth, yellowish brown in KOH. Subhymenium a layer of subparallel hyphae, 1.5–4 µm diam., smooth, yellowish brown in KOH. Pileipellis an epithelium of isodiametric to pyriform elements, 11.5–29.5 µm diam., smooth, hyaline in KOH. Pileocystidia scarses, and in fascicles in the pileus margin 24–45 × 5.5–10 µm, lageniform to lageniform-subcapitate, thin-walled, hyaline in KOH (Fig. 9). Hypodermium with interwoven, filamentous hyphae, 2.5–8.6 µm diam., smooth, light brown in KOH. Pileus trama with irregular and inflated hyphae, 8–34.5 µm diam., yellowish brown in KOH. Stipitipellis a cutis, composed of filamentous hyphae 3–4 µm diam., smooth, yellowish brown in KOH. Stipite trama regular, 4.5–18 µm diam., smooth, yellowish brown to green grayish in KOH, slightly thickened. Caulocystidia 22–47 (–94.5) × 7.5–14 µm, sphaeropedunculate, clavate or lageniform, non-incrusted at apex, hyaline in KOH (Fig. 10). Clamp connections present.

Examined specimens: Brazil. Paraná State, Palotina, P.E. São Camilo, alt. 332 m, solitary and in small groups, in pasture, on cow dung, 25 May 2015, A. G.S. Silva-Filho 439 and 440 (HCP 1027, HCP 1028); *ibid*, 21 Jun 2016, A. G.S. Silva-Filho 783 (HCP 1030).

Distribution: Cosmopolitan (Guzmán et al., 2000).

Copelandia mexicana Guzmán, Bol. Soc. Mex. Micol. 12: 27 (1978) Figures (3-5, 11-15)

Pileus 6–10 mm diam., at first convex, umbonate, convex slightly umbonate when mature, surface smooth, slightly striated to strongly translucent striated almost up to center, hygrophanous, at first olive brown (4D10), olive (3F4), margin greyish green (1D4), at maturity brownish grey (5C2, 5D2) to light grey (5D1), margin pastel grey (5C1) to pale grey (5B1) (Figs. 3-5). Lamellae adnexed, crowded, with 2 lamelullae, edge even to slightly wavy, pale discolor with the sides, consistency fleshy, at first pastel grey (5C1), light grey (5D1) to olive grey (1D2), becoming brown (5F6) at maturity (Fig. 4). Stipe 11–56 × 1–3 mm, central, cylindrical, equal to slightly bulbous at base, fistulose, surface smooth, velutinous near the apex, consistency fleshy, with white mycelial pad in young specimens, at first greyish brown (6D5) at apex, yellowish grey (4B2) at base, in maturity specimens pastel grey (5C1) to light grey (5D1) at apex, greyish brown (5D3) to brown (5E5) at center toward the base (Fig. 5). Context thin (1–1.5 mm thick), fleshy, brownish grey (5C2), olive brown (4D1). Veil absent. Spore print not observed.

Basidiospores 6–9 × 4.5–6.5 µm (Q= 1.16–1.89, Qm= 1.44, n=75/3/3), lenticular, limoniform in face-view, broadly ellipsoid in side-view, with truncate base and distinct germ-pore, thick-walled, reddish brown in KOH (Fig. 11), not bleaching in 95–98% sulfuric acid. Basidia 13–18 × 5–12 µm, cylindro-clavate to clavate, hyaline, tetrasporic. Pleurocystidia 24–50 × 7–16 µm, as metuloids, not abundant, pedicellate-utriform, some subcylindrical or subfusoid with obtuse apex, thick-walled, <1 µm at the base and central portion, 1.5–3 µm in extreme apex, which also is incrusted crystals at apex (muricate), light brown in KOH (Fig 13). Cheilocystidia 24–37 × 4–9 µm, abundant, obclavate, lageniform, slightly thickened, walls <1 µm, without

crystals incrusted at apex, hyaline in KOH, rarely thick-walled with crystals incrusted at apex (Fig. 14). Lamella edge sterile (Fig 12). Lamellar trama irregular, with filamentous to inflated hyphae 5.2–15 µm diam., smooth, yellowish brown in KOH. Subhymenium with filamentous hyphae, 1.6–3.5 µm diam., smooth, light brown in KOH. Pileipellis an epithelium of cylindrical, isodiametric to pyriform elements, 9.5–22 µm diam., smooth, yellowish brown in KOH (Fig. 16). Pileocystidia scares 22–40 × 4–8.5 µm, vesiculose-clavate to lageniform, thick-walled 0.5–1.5 µm, mostly yellowish brown in KOH, rare brownish (Fig. 17). Hypodermium a layer of filamentous hyphae, 2–8.5 µm diam., parallel, horizontally arranged, smooth, light brown in KOH. Pileus trama with inflated hyphae 3–5.5 µm diam., yellowish brown in KOH. Stipitipellis composed of a cutis of filamentous hyphae 1–3.5 µm diam., parallel, smooth, yellowish brown in KOH. Stipe trama regular, with inflated hyphae, 4.5–19.5 µm diam., smooth, yellowish brown in KOH. Caulocystidia 14–49 × 3–11 µm, pyriform, cylindrical, lageniform, digitate, slightly thickened, walls <1 µm, non-incrusted at apex, hyaline in KOH (Fig. 15). Clamp connections absent.

Examined specimens: Brazil. Paraná State, Terra Roxa, RPPN Fazenda Açu, alt. 332 m, solitary on decaying wood, 15 Jun 2015 A. G.S. Silva-Filho 491 (HCP 1031); *ibid*, 14 Oct 2015, A. G.S. Silva-Filho 632 (HCP 1032); *ibid*, 12 Nov 2015, A. G.S. Silva-Filho 641 (HCP 1033).

Distribution: Previously known only from Mexico (Guzmán et al., 2000) and now from Brazil.

DISCUSSION

The basidiospores not bleaching in 95-98% sulfuric acid and the metuloidal pleurocystidia are feature that accommodates our species in *Copelandia*, subfamily *Panaeoloideae* Singer (Pegler, 1983; Singer, 1986).

Copelandia cyanescens compared with our *C. mexicana* specimens, produces more robust basidiomata, with larger pileus (22–56 mm), margin non striated, large basidiospores (11.5–14.5 × 9–11 µm), metuloidal pleurocystidia with pale yellowish brown walls, and hyphae with clamp connection.

The metuloidal pleurocystidia with deep green apex (Fig. 7) is a noteworthy feature that distinguishes *Copelandia chlorocystis* Singer & Weeks of other species this genus. This feature was observed in our collections of *C. cyanescens*, but according to original description, *C. chlorocystis* has smaller basidiospores (10.3–13 × 8–9.5 µm), which are produced in two and tri-spored basidia, and apparently don't grows on any kind of dung (Weeks, 1979). *Copelandia mexicana* is characterized by the non-coprophilous habitat, small pileus (≤10 mm) and basidiospores (≤ 9 µm long), metuloidal pleurocystidia with crystals incrusted at apex with light brown content in KOH and presence of pileocystidia (Guzmán, 1978). All these features are in agreement with south Brazilian materials, supporting the identification. It seems to be a rare and poorly known species of *Copelandia*, originally described from México.

In the same manner, as mentioned by Guzmán (1978) in the protologue, our sample collection of *Copelandia mexicana* did not turned conspicuously blue when wounded or touched, as reported in the most species of *Copelandia* (Gerhardt, 1996). However, the black spots noted in the dried basidiomata could be an evidence of this character, suggesting it to be a neurotropic fungus. *Copelandia mexicana* was described with brownish pileus and stipe (Guzmán, 1978) and in our collection was observed this feature only in younger specimens (Fig. 3) that subsequently become greyish in mature specimens (Figs. 4-5). In addition, our specimens have cheilocystidia with a swollen base (Fig. 14), while the original description and illustration this is not reported.

Copelandia tropica Natarajan & Raman from India and *C. mexicana* are closely related species; both has smaller basidiospores (≤ 9 µm long), non-coprophilous habit and hyphae without clamp connections, larger pileus (35 mm), longer (100 mm) and white stipe, as well as absence of pileocystidia (Natarajan and Raman, 1983). *Copelandia affinis* Horak is

another species that grows on soil and occasionally on decomposed wood (Horak, 1980). However, the mushroom from Papua New Guinea has larger pileus (25 mm) with a disc around conspicuously wrinkled, longer basidiospores (9–10 × 5–6.5 µm), larger cheilocystidia 9–14 µm diam., and clamp connection (Horak, 1980).

Copelandia mexicana is described by Guzmán (1978) as a species of *Copelandia*, but Gerhardt (1996), in a world revision of *Panaeolus* (including *Copelandia* as subgenus), considered that species as nom. excl., referring especially to the pale color of the basidiospores in KOH and the non-typical cystidia, which he reminded those of *Inocybe*. (Fr.) Fr., Gerhardt (1996) cannot assign *C. mexicana* to any known genus, but concludes that it does not belong to his concept of *Panaeolus*. However, Guzmán et al. (2000), in their world catalogue of neurotropic fungi, listed *C. mexicana* as an autonomous species. Based on the examination of Brazilian collections, the general morphology (both macro- and microscopical) recalls *Panaeolus* and allies.

Copelandia cyanescens is a common species found in pastures growing on cow dung (Weeks, 1979) and the widest distributed species of the genus, reported from all continents, especially due to general interest as neurotropic mushroom – although possibly misidentified for many times. In Brazil there are few records and the distribution is poorly known. Wartchow et al. (2010) recorded from Pernambuco and de Meijer (2006) from Paraná States as *Panaeolus cyanescens* (Berk. & Broome) Sacc. *Copelandia mexicana* up to now was only known from México, according to Guzmán et al. (2000), and therewith we expanded its distribution to South America, with possible occurrence throughout the Neotropical Forests from South America to Mexico.

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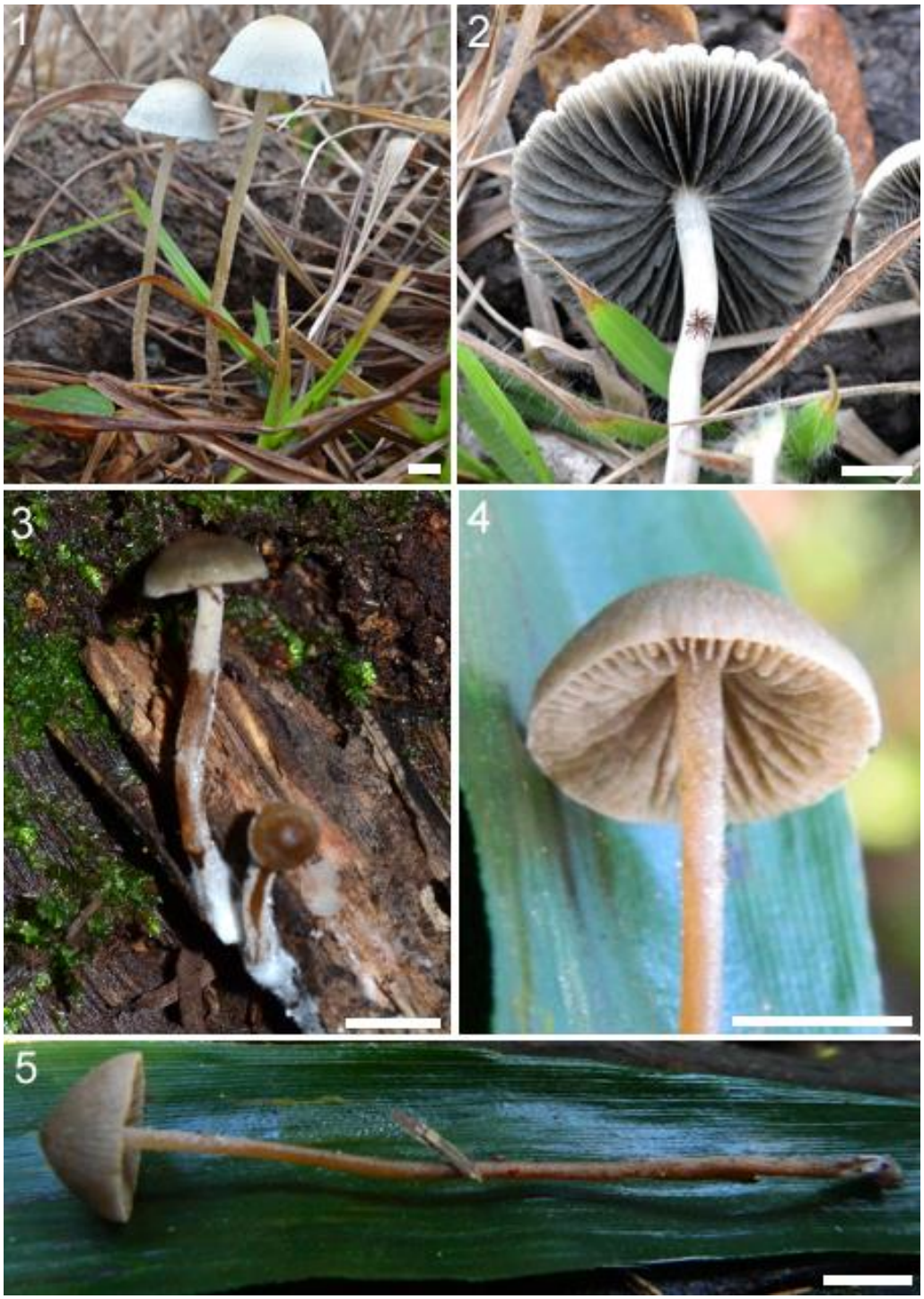

Figure 1-5 *Copelandia* basidiomata**:** 1,2 *Copelandia cyanescens* - HCP 1030. 3-5 *Copelandia mexicana*. 3.4 HCP 1031; 5 HCP 1032. Scale bar = 5 mm. Photos: Alexandre Silva-Filho.

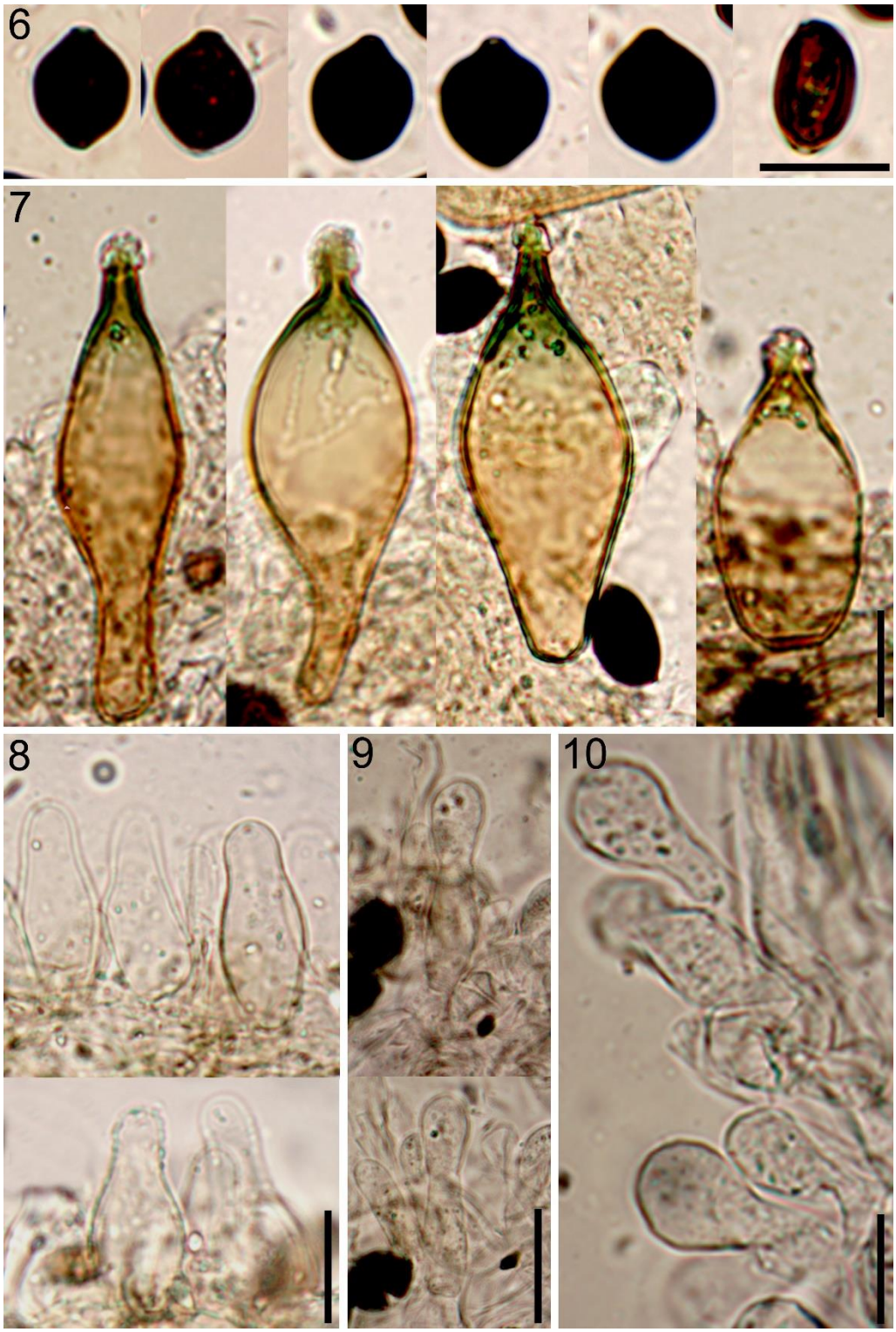

Figure 6-10 *Copelandia cyanescens* - HCP 1030. 6 basidiospores. 7 pleurocystidia. 8 cheilocystidia. 9 Pileipellis. 10 caulocystidia. 6-10. Scale bar = 10 µm. Photos: Alexandre Silva-Filho.

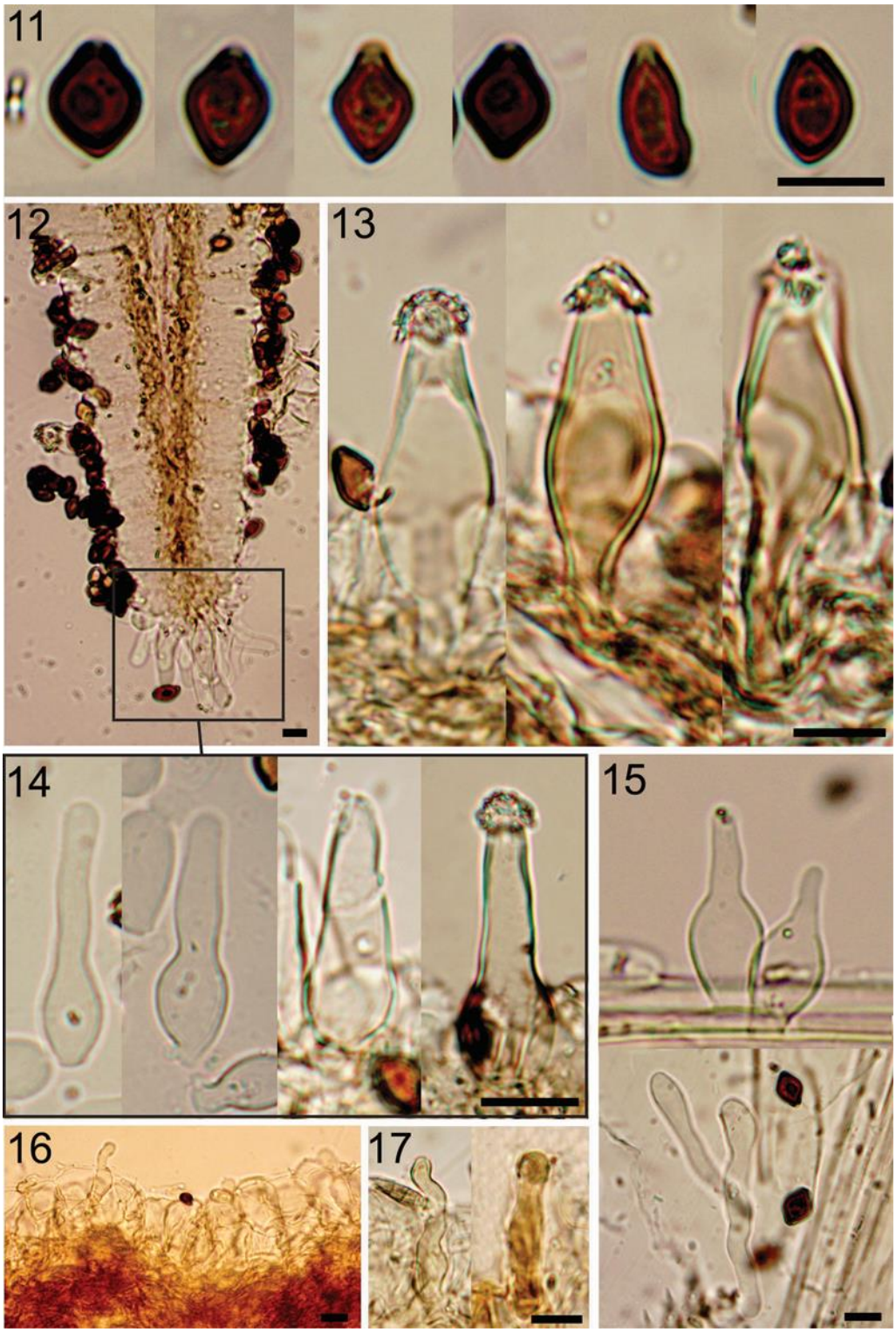

Figure 11-17 *Copelandia mexicana* - HCP 1031. 11 basidiospores. 12 section of lamellae. 13 pleurocystidia. 14 cheilocystidia. 15 caulocystidia. 16 pileipellis. 17 pileocystidia. Scale bar = 10 µm. Photos: Alexandre Silva-Filho.

6 **Capitulo 3**: Artigo a ser submetido à Darwiniana

CLITOCELLA AND *RHODOCYBE* (*ENTOLOMATACEAE*) FROM WESTERN PARANÁ STATE, BRAZIL

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ABSTRACT

In a survey of Agaricales fungi in Seasonal Semidecidual Forest remnants from Paraná State, southern Brazil, two *Clitocella* and two *Rhodocybe* species were identified. Based on morphological data *Clitocella pallescens* is described as a new species and a new combination is proposed to *Clitocella himantiigena. Rhodocybe galerinoides* and *C. himantiigena* are new records from Brazil. *Rhodocybe caelatoidea*, already registered in Paraná State, is also described, illustrated and discussed.

Key Words: agaricoid fungi; Atlantic Forest, mycobiota, morphology, taxonomy

RESUMEN

En un estudio de hongos del orden Agaricales, en los remanentes del bosque estacional semidecidual en el estado de Paraná al sur de Brasil, fueron identificadas dos espécies de *Clitocella* y dos de *Rhodocybe*, el cual *Clitocella pallescens* es una nueva especie para la ciencia y descrita en base a datos morfológicos. Además, una nueva combinación es propuesta, *Clitocella himantiigena*. *Rhodocybe galerinoides* y *C. himantiigena* son nuevos registros para Brasil. *Rhodocybe caelatoidea* és descrita, ilustrada y discutida, una especie registrada para el estado del Paraná.

Palabras Claves: Bosque Atlántico; hongos agaricoides; micobiota; morfología; taxonomía

INTRODUCTION

Agaric fungi belonging to the *Rhodocybe-Clitopilus* clade are placed in *Entolomataceae* Kotl. & Pouzar and accommodates mushroom species recognized by the presence of attached lamellae and basidiospores that appear angular in face and profile, with pinkish color in deposit (Singer, 1986; Baroni, 1981; Largent, 1994; Co-David et al., 2009). The classification of this group has been subject of recent discussion: Co David et al. (2009), based on basidiospores ultra-structure and molecular analysis, proposed to include members of *Rhodocybe-Clitopilus* clade,

into a single genus, *Clitopilus* (Rabenh.) P. Kumm.; based on larger subset analysis of specimens of the *Rhodocybe-Clitopilus* clade, Baroni & Matheny (2011) recognized and proposed four major clades: *Clitopilus-Rhodocybe* p.p., *Clitopilopsis, Rhodocybe* s. str. and *Rhodophana*. Kluting et al. (2014), presented a new approach based on a multigene phylogeny and proposing new topology for the phylogenetic tree with five monophyletic clades, splitting *Clitopilus* in five genera: *Clitopilus*, *Clitocella* Kluting, T.J. Baroni & Bergemann, *Clitopilopsis* Maire, *Rhodocybe* s.str. Maire, and *Rhodophana* Kühner. In a more recent paper, Morgado et al. (2016) reached similar phylogenetic results, indicating a more established classification for thesse clade.

In Brazil, the genus *Rhodocybe* has 12 recorded species (Maia et al., 2015). Raithelhuber (1990) described *Rhodocybe oenocephala*, Singer (1973, 1989) described three species: *R. crepidotoides*, reported later by Pegler (1997), *R. angustipora* and *R. conica*. Recently de Meijer (2008) described *Rhodocybe levispora* de Meijer, and recorded *R.* aff. *albovelutina* (Stevenson) E. Horak, *R.* cf. *caelata* (Fr.) Maire, *R. caelatoidea* Dennis, *R.* aff. *conchata* E.Horak, *R.* aff. *mellea* T.J. Baroni & Ovrebo, *R.* cf. *mycenoides* Singer, and *R. pseudonitelina* Dennis (de Meijer, 2006). *Clitocella* is, up to now, an unknown genus in Brazil.

In a survey of agaricoid fungi in areas of Seasonal Semideciduous Forest in the western Paraná State, specimens of *Clitocella* and *Rhodocybe* were gathered and we report such materials, aiming to improve the knowledge of south Brazilian mycobiota.

MATERIALS AND METHODS

Fieldwork was conducted from January to December 2015 in two fragments of seasonal semideciduous forest, belonging to the Atlantic Forest Biome, in the western region of Paraná State, southern Brazil: Parque Estadual São Camilo (abbreviated as PESC), in the municipality of Palotina (24°18'26"S and 53°54'29" W), and Reserva Particular do Patrimônio Natural Fazenda Açu (abbreviated as RPPN Fazenda Açu), situated in the municipality of Terra Roxa

(24°11'54" S and 53°58'4" W). Collected specimens from 2010–2014 at PESC were also examined and considered in the present survey.

All specimens were analyzed both macro-and micromorphologically following standard procedures (Baroni, 1981). Color names and codes used in the macroscopical descriptions are according to Kornerup and Wanscher (1978); colors in microscopic features are under 3% KOH, unless indicated. Microscopic measurements and photographs were made under an Olympus CX31 optical microscope with a Toup Cam FMA050 digital camera, and measurements were taken through software Toup tek, Toup View 3.7. In the basidiospores description Q is the quotient between the length and width, Qm is the medium value of Q and n is the number of measured basidiospores/number of analyzed basidiomata/number of collections.

Scanning electron microscopy (SEM) studies followed the modified procedure by Baroni (1981) and were performed at the Center of Electron Microscopy of the Federal University of Paraná (UFPR) at Curitiba, under a Jeol JSM-6360LV. Specimens are preserved at the Herbarium of Campus Palotina (HCP), except the types, housed at the Herbarium of Department of Botany (UPCB) in Curitiba. Taxonomy follows Kluting et al. (2014).

RESULTS

Clitocella himantiigena (Speg.) Silva-Filho & Cortez, **comb. nov.** Fig. 1A-B, 2A-F, 6A

Basonym: *Clitocybe himantiigena* Speg. Bol. Acad. Nac. Cienc. Córdoba 23: 373 (1919)

≡*Rhodocybe himantiigena* (Speg.) Singer, Lilloa 22: 609 (1951)

≡*Clitopilus himantiigenus* (Speg.) Noordel. & Co-David, Persoonia 23: 162 (2009)

Pileus 67–81 mm diam., at first plane to slightly umbonated at the disc, infunbiliform in mature specimens slightly depressed at disc, surface smooth to slightly pruinose, margin involute, non-striate, rimose, yellowish brown (5D5) to greyish brown (6F3) at the center and

dark brown (6F5) at the margin. Lamellae decurrent, crowded, with 5 sizes of lamelullae, margin even to wavy, concolor with the sides, fleshy, greyish yellow (1B2) to brownish grey (6D2). Stipe 31–33 × 13 (apex) – 8–9 (base) mm, central, cylindrical, at first equal, in mature species tapered at base, surface striated, consistency fleshy, brownish grey (5C2), with white (1A1) rhizomorphs (Fig. 1A–B). Context thin (2.5 mm thickness), pale grey (1A2). Spore print not observed. Spot test: not producing a reddish color reaction in KOH 3% at pileus in dried specimens.

Basidiospores 5–8 × 3.5–5.5 µm, (n=30, Q=0.84–1.76, Qm=1.40), short-broadly ellipsoid in profile view, globose in polar view, with obscure pustules, appearing almost smooth and with minute or obscure angles in polar view, hilar appendix conspicuous, thin-walled, hyaline, inamyloid (Fig. 2A–6A). Basidia 23–33 × 6.5–7.5 µm, clavate, tetrasporic, rarely mono- or bisporic, hyaline (Fig. 2B). Pleurocystidia and cheilocystidia absent (Fig. 2C). Lamella edge fertile. Pseudoparaphyses on lamella edge, 15–30 × 3–9 µm, filiform, cylindroclavate, rare branched at apex, septate, hyaline (Fig. 2D). Lamella edge fertile. Lamellar trama irregular with hyphae 3–6 µm diam., smooth, hyaline in KOH (Fig. 2C). Pileus trama with interwoven hyphae, 4.5–10.5 µm diam., smooth, hyaline. Pileipellis a cutis of interwoven hyphae, 3-5 µm diam, composed of two layers: the uper layer with hyphae smooth and hyaline, the lower layer with hyphae brown incrusted, hyaline and brown (Fig. 2E–F). Stipitipellis composed of a cutis of subparallel hyphae 2–7 µm diam., incrusted, hyaline. Stipititrama regular, with hyphae 2–4 µm diam., slightly incrusted, hyaline. Caulocystidia 13.6–36 × 3–6.5 µm, catenulate, clavate, cylindro-clavate, hyaline. Clamp connections absent. Oleiferous hyphae (thrombopleurous) observed only in lamellar trama (Fig. 2C) and stipititrama.

Distribution and habitat: Solitary in the forest, terricolous, among litter fall, possibly arising from buried wood. Known only from Paraguay and Argentina (Singer, 1949) and now in Brazil.

Specimens examined: BRAZIL. **Paraná**. Palotina. PESC, 09-VI-2010; A. J. Ferreira & D. Souza 3-2 (HCP 1019); 22-I-2015, M. A. Teixeira-Silva 058 (HCP 1018), 11-V-2015, A. G. S.

Silva-Filho 394, (HCP 1144); RPPN Fazenda Açu. Terra Roxa, 20-IV- 2015, A. G. S. Silva-Filho 282, HCP (1016); 04-V-2015, A. G. S. Silva-Filho 361, (HCP 1017).

Observations: *Clitocybe himantiigena* was described by Spegazzini (1919) based on a collection from Paraguay, which Singer (1949) transferred to *Rhodocybe* and provided a detailed description. After molecular studies, Co-David et al. (2009) combined this species to *Clitopilus.* However, based on the above cited features and recent results by Kluting et al. (2014), *C. himantiigena* is considered a good member of *Clitocella*, reason for which we propose the combination to that genus.

Clitocella himantiigena was identified based Singer (1949) description, who reported the following features: robust basidiomata with dark colored pileus (Fig. 1A,B), basidiospores size (4.3–8 × 3.7–5 µm, Fig. 2A), absence of pleuro- and cheilocystidia (Fig. 2C), presence of versiform pseudoparaphyses (Fig. 2D) and pileipellis a cutis of incrusted brown pigments (Fig. 2E-F).

Clitocella himantiigena and *C. mundula* are similar species and, as well as in *C. obscura* (Pilát) Vizzini, T.J. Baroni, E. Sesli & Antonín and *C.popinalis* (Fr.) Kluting, T.J. Baroni & Bergemann, all react positively to reddish under 3% KOH on the dried pileal surface. In addition, *C. himantiigena* and *C. mundula* have similar basidioma stature, pileus size and surface, lamellae insertion, stipe size, color and surface, but the pileus color of *R. himantiigena* is darker, in comparison with European and North American specimens of *C. mundula* which range from pale to dark grey (Baroni, 1981). The basidiospores of *C. himantiigena* are longer (5–8 × 3.5–5.5 µm, in our specimens; 4.3–8 × 3.7–5 µm in Singer, 1949) and predominantly short to broadly ellipsoid in profile view (Fig. 6A), while in *C. mundula* they are shorter (5–6.5 × 4–5 µm), subglobose to obovoid in profile and face view (Pegler & Young, 1975). In addition, Singer (1949) reported filiform, cylindro-clavate, rarely branched pseudoparaphyses, which were observed in our collection (Fig. 2D) and are not reported in *C. mundula* (Baroni, 1981).

Baroni (1981) placed *R. himantiigena* in the synonymy of *R. mundula.* He studied the material type from Paraguay and only commented that in South America, *R. mundula* is known only from this area (i.e., Paraguay). Also is not reported *R. himantiigena* in your excluded and doubtful species.

By the set of the above cited features and by the collecting area close to Paraguay (Spegazzini, 1919) and northern Argentina (Singer, 1949), we propose that *C. himantiigena* is a South American species, distinct of *C. mundula*, which is distributed in the northern hemisphere, especially North America and Eurasia (Noordeloos & Gates, 2012).

Clitocella pallescens Silva-Filho & Cortez **sp. nov.** Mycobank: MB xxxx. TYPE: BRAZIL. **Paraná**. PESC, 03-II-2015, A. G. S. Silva-Filho 172 (UPCB). Fig. 1C-D, 3A-E, 7 B-C.

Diagnosis: Basidiomata clitocyboid, pileus 13–30 mm diam., infundibuliform to plano-convex, white to pastel grey, lamellae decurrent, stipe cylindrical, with mycelial pad and rhizomorphs, basidiospores 4–5 × 3–4.3 µm, globose to subglobose, smooth to slightly angled in polar view, cystidia absent, pileipellis a transition between trichocutis and a trichoderm, clamp connection absent.

Pileus 13–30 mm diam., infundibuliform when young, plane to plano-convex or depressed when mature, surface smooth, margin smooth, abrupt, lobed, rimose, pastel grey (1C1) to pale grey (1B1) at the center and pale grey (1B1) to white (1A1) at the margin. Lamellae decurrent, crowed, with 2 sizes of lamelulae, margin even to eroded, concolor with the sides, consistency fleshy to coriaceous, white (1A1), pale grey (1B1) to greenish yellow (1C2). Stipe 12-15 × 1–3 (apex) 3–6 mm (base), central, cylindrical tapered at the apex, pale grey (1B1) to yellowish white (1A2), consistency fleshy, smooth to slightly striated, with white mycelial pad

and rhizomorphs (Fig. 1C–D). Context thin (<1mm thickness), pale grey (1B1). Spore print not observed. Spot test: not producing a reddish color reaction in KOH 3% at pileus.

Basidiospores 4–5 × 3–4.3 µm (n=50/3/1, Q=1.42–1.45, Qm=1.16), globose to subglobose, in profile view, globose in polar view, with obscure pustules, almost smooth or with minute and obscure angles in polar view, hyaline, thin-walled, inamyloid (Fig. 3A–6B–C). Basidia 17–26 × 4.5–6 µm, clavate to cylindro-clavate, uni, bi and tetrasporic, hyaline (Fig. 3B) . Pleurocystidia and cheilocystidia absent. Lamella edge fertile. Lamellar trama irregular, with hyphae 2.5–5.5 µm diam., smooth, hyaline (Fig. 3C). Pileus trama with interwoven hyphae, 2–6 µm diam., prostrate, smooth, hyaline (Fig. 3D). Pileipellis a transition between trichocutis and trichoderm, with subparallel hyphae, 2.5–6.5 µm diam., slightly gelatinized, smooth hyaline (Fig. 3D–E). Stipitipellis a cutis of parallel hyphae 1.6–3.6 µm diam., smooth, hyaline. Stipititrama irregular with hyphae 1.5–5 µm diam., smooth, hyaline. Caulocystidia absent. Clamp connections absent. Oleiferous hyphae (thrombopleurous) observed in the lamellar trama.

Etymology: From Latin '*pallida*' (pale), referring to the whitish color of the basidiomata.

Distribution and habitat: Solitary or gregarious on rotten wood. Known only from type locality.

Specimens examined: BRAZIL. **Paraná**. PESC, 03-II-2015, A. G. S. Silva-Filho 172 (HCP Isotypus).

Observations: *Clitocella pallescens* is a proposed new species, based in the singular morphology. The centrally stipitate basidiomata, pileus whitish, and decurrent lamellae, place it in *Rhodocybe* sect. Decurrentes sensu Baroni (1981), whose species are briefly discussed as follows. According to Baroni (1981, as *Rhodocybe*): *C. mundula, C. obscura* and *C. popinalis* (Fr.) Kluting, T.J. Baroni & Bergemann produce a reddish reaction in 3% KOH; *Rhodocybe hirneola* (Fr.) P.D. Orton, does not react reddish but have grayish to dark grayish color in the pileus, and cheilocystidia; *R. heterospora* (Murrill) T.J. Baroni has interwoven hyphae in lamellar trama and the basidiospores are larger (5.5–7 × 5.5–6.5 µm); *R. porcellanica* (Dennis)

E. Horak, *R. semiarboricola* T.J. Baroni and *R. mairei* T.J. Baroni have parallel to sub-parallel hyphae in lamella trama, but these species have grayish to dark grayish color at the pileus and basidiospores are subglobose to short-broadly-ellipsoid and longer (≥ 5µm); *Clitocella fallax* (Quél.) Kluting, T.J. Baroni & Bergemann does not react under 3% KOH, the basidioma is white to off-white and the lamellae trama is parallel, as well as *C. pallescens.* However, *C. fallax* has more robust basidiomata, the pileus is larger (30–40 mm diam.) and with a mammilate central umbo, rhizomorphs are absent, basidiospores are amygdaliform to ellipsoid and larger (6.5–8 × 4–6.5 µm), the pileipellis is a loosely entangled layer of ascending cylindrical hyphae (Baroni, 1981).

In addition, *C. fallax* is distributed along the northern hemisphere (Europe and North America, Kluting et al. 2014). Thus, our sample collection present unique features, as white to off-white pileus (Fig. 1B,C), not producing a reddish reaction in KOH 3%, absence of pseudocystidia (Fig. 3C) and small (≤ 5 µm long) globose to subglobose basidiospores (Fig. 3A). Based on the combination of these features, we propose it as a new species of *Clitocella.*

Rhodocybe caelatoidea Dennis, Kew Bull. 15: 154 (1961) Fig. 1E, 4A-G, 6D

≡ *Clitopilus caelatoideus* (Dennis) Noordel. & Co-David, Persoonia 23: 161 (2009)

Pileus 12–25 mm diam., convex, slightly depressed at the disc, surface smooth, margin incurved, smooth to slightly translucent striate, lobed, orange (6B7) to brownish orange (7C8). Lamellae adnate to deccurent, close to subdistant, with 3 sizes of lamellulae, margin slightly wavy, concolor with the sides, membranous, orange grey (6B3), greyish orange (6B4). Stipe 23–31 × 2–4 mm, central, cylindrical to slightly compressed, surface smooth and velutinous near the apex, consistency fleshy to coriaceous, brownish orange (7C8), greyish orange (5B4), with basal mycelium (Fig. 1E). Context thin (1–3 mm thickness), light orange (6A5). Spore print not observed.

Basidiospores 7–8.5 × 5–6.5 µm, (n= 50/2/2, Q= 1.09–1.36, Qm= 1.21), subglobose to short ellipsoid in profile view, globose to subglobose and angular in polar view, undulate-postulate in all views, hilar appendix evident, thin-walled, hyaline, inamyloid (Fig. 4A–6D). Basidia 25–29 × 6.5–8 µm, cylindro-clavate to clavate, bi and tetrasporic, hyaline (Fig. 4C). Pleurocystidia and cheilocystidia as pseudocystidia, 32–46 × 3–6 µm, ventricose-rostrate, ventricose to lageniform, with brightly yellowish contents, granulate or coagulated, scattered, non-abundant, originated from lamellar trama, a little projecting from the hymenium (Fig. 4B–D). Lamella edge fertile. Lamellar trama subregular, with hyphae 4–5 µm diam., smooth, hyaline. Pileus trama irregular, with hyphae 3–5.5 µm diam., hyaline. Pileipellis composed of a layer of entangled hyphae, 2.5–6 µm diam., slightly incrusted, hyaline, terminal elements filiform, forming a nearly a trichodermium, 26–43 × 4.5–8.5 µm (Fig. 4E–F–G). Stipitipellis is a cutis, hyphae 2.5–3.5 µm diam., light brown, incrusted, with fusiform and incrusted terminal elements, 46 × 4 µm. Stipititrama subregular, with hyphae 2–6 µm diam., smooth, with brightly yellowish contents, granulate or coagulated. Caulocystidia absent. Oleiferous hyphae (thrombopleurous) scarce in pileipellis. Clamp connections absent.

Distribution and habitat: Gregarious or solitary on decaying wood. Neotropical species, known only from South and Central America (Dennis, 1961, Horak, 1978, Pegler, 1983). In Brazil, de Meijer (2006) reported the species from Paraná state.

Specimens examined: BRAZIL. **Paraná**. PESC, 2-III-2015, A. G. S. Silva-Filho 167 (HCP 1023), 11-V-2015, A. G. S. Silva-Filho 372 (HCP 1025), 1-VI-2015, A. G. S. Silva-Filho 513 (HCP 1024).

Observations: *Rhodocybe caelatoidea* belong to *Rhodocybe* sect. Rhodocybe sensu Baroni (1981), due to presence of hymenial pseudocystidia (Fig. 4B,D), centrally stipitate basidiomata (Fig. 1E,F) and absence of clamp connections. This species was collected in this survey and can be confounded in the field with *R. galerinoides* due smaller reddish basidiomata. However, *R. caelatoidea* has non-hygrophanous and larger pileus (12–25 mm), convex, slightly depressed at

the disc (Fig. 1E), while *R. galerinoides* is hygrophanous with smaller pileus (7–14 mm), conical to convex, umbonate to papillate at the disc (Fig. 1F).

Microscopically, the basidiospores of *R. caelatoidea* are bigger (7–8.5 × 5–6.5 µm, Fig. 4A) than those of *R. galerinoides* (4.5–6.5 × 4–5 µm, Fig. 5A), the pileipellis has incrusted and oleiferous hyphae (Fig. 4 F), in contrast to the smooth hyphae (Fig. 5E, F) in the pileipellis of *R. galerinoides*. Baroni (1981) accommodated *R. caelatoidea* in the group with terrestrial basidiomata, however the Antillean collections by Pegler (1983) were lignicolous, as well our sample collections which were gathered on very decayed wood and litter fall. *Rhodocybe retroflexa* (Berk. & Broome) Pegler, from Sri Lanka, is similar to *R. caelatoidea*, but differs by the cream-buff pileus and the pileipellis formed by an undifferentiated cutis of radial hyphae, without anticlinal terminal elements (Pegler, 1997).

Rhodocybe galerinoides Singer, Sydowia 15: 81 (1962) Fig. 1F, 5A-F 6E

≡ *Clitopilus galerinoides* (Singer) Noordel. & Co-David, Persoonia 23: 161 (2009)

Pileus 7–14 mm diam., conical to convex, umbonate to papillate at disc, surface velutinous to slightly fibrillose towards the margin, margin irregular, incurved, non striated, orange (6A6) to brownish orange (6C7). Lamellae subdecurrent, abundant, close, with 3–5 sized lamelullae, semicircular, margin entire and slightly wavy, concolor with the sides, membranous, greyish orange (6B3–6B4). Stipe 19–27 × 1–2 mm, central, cylindrical to slightly claviform, velutinous near the apex, coriaceous, concolor to pileus, with basal mycelium. Context thin (less 5 mm thick), pale grey (1B1). Spore print not observed.

Basidiospores 4.5–6.5 × 4–5 µm, (n= 50/2/2, Q= 1.09–1.36, Qm= 1.21); globose to subglobose in profile view, globose and angular in polar view, undulate-postulate in all view, thin walled, hilar appendix evident, hyaline, inamiloid (Fig. 5A–6E). Basidia 24.5–35 × 5.5–6.5 µm, cylindro-clavate to clavate, tetrasporic, hyaline (Fig. 3D). Pleurocystidia and cheilocystidia

as pseudocystidia, 32–76 × 4–7 µm, ventricose, ventricose-rostrate to lageniform, with brightly yellowish contents, granulate or coagulated, scattered to abundant, originated from lamellar trama, a little projecting from the hymenium(Fig. 3B–C). Lamella edge fertile. Lamellar trama regular, with hyphae 3.5–6.5 µm diam., slightly incrusted, hyaline and light brown (Fig. 3C). Pileus trama regular, with hyphae 8.5–11 µm diam., some slightly incrusted, light brown. Pileipellis composed of a layer of entangled hyphae, 2–5 µm diam., with some anticlinal terminal elements, 13.5–35 × 3–5 µm, forming a nearly a trichodermium, septate, smooth to slightly incrusted, light brown to brown(Fig. 5E–F). Stipitipellis composed of a cutis, hyphae 3–6 µm diam., hyaline and light brown. Stipititrama subregular, with hyphae 1.5–4.5 µm diam., incrusted, with brightly yellowish contents, granulate or coagulated. Caulocystidia absent. Clamp connections absent.

Distribution and habitat: Gregarious on decaying wood. Previously known only from Bolivia (Singer, 1962), it is now reported for the first time in Brazil.

Specimens examined: BRAZIL. **Paraná**. Palotina, PESC, 22-I-2013, M. A. Teixeira-Silva 060 (HCP514); 11-V-2015, A. G. S. Silva Filho 393 (HCP 1020); Terra Roxa, RPPN Fazenda Açu, 12-XI-2015, A. G. S. Silva Filho 643 (HCP 1021).

Observations: *Rhodocybe galerinoides* even as *R. caelatoidea* are classified in Section Rhodocybe sensu Baroni (1981) as previosly cited and was named by virtue of small basidiomata (7–14 mm diam), as well as the lignicolous habitat among mosses, as some *Galerina* Earle species. *Rhodocybe nitellinoides* E. Horak presents basidioma similar in size and color, but differs in the non-hygrophanous pileus, ovoid basidiospores, and pileipellis with incrusted yellow hyphae (Horak, 1979).

Rhodocybe pruinosistipitata T.J. Baroni, Largent & Aime, from Guyana is also comparable to *R. galerinoides* by the virtue of similar basidiomata, basidiospore shape and presence of pseudocystidia, but differs in the larger size of pileus (15–30 mm diam.) and stipe

(35–57 × 3–3.5 mm), presence of white pruina over stipe surface, larger basidiospores (6.8–8.1 × 4.7–6.8 µm), and incrusted hyphae of stipe trama (Henkel et al., 2010).

Rhodocybe galerinoides was described and is only known from Bolivia (Singer, 1962), thus it is the first record from Brazil and the second for this species.

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Fig. 1. Basidiomata. **A-B,** *Clitocella himantiigena*. **C-D**, *C. pallescens*. **E,** *Rhodocybe caelatoidea*. **F,** *R. galerinoides.* A and B, A. G. S. Silva-Filho 394, (HCP 1144); C and D, A. G. S. Silva-Filho 172 (HCP); E, A. G. S. Silva-Filho 167 (HCP 1023); F, M. A. Teixeira-Silva 060 (HCP514).

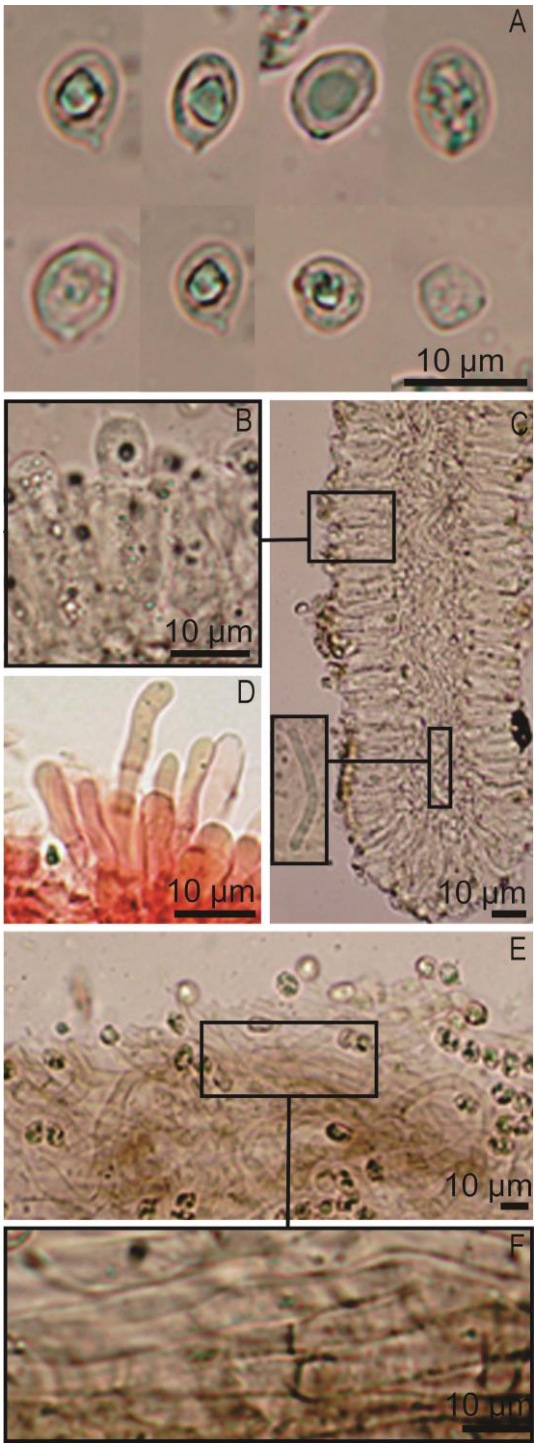

Fig. 2. *Clitocella himantiigena*. **A,** basidiospores. **B,** basidium. **C,** section of lamellar trama with oleiferous hyphae. **D,** pseudoparaphyses. **E,** pileipellis. **F,** smooth and encrusted hyphae of pileipellis. A-F, A. G. S. Silva-Filho 394, (HCP 1144).

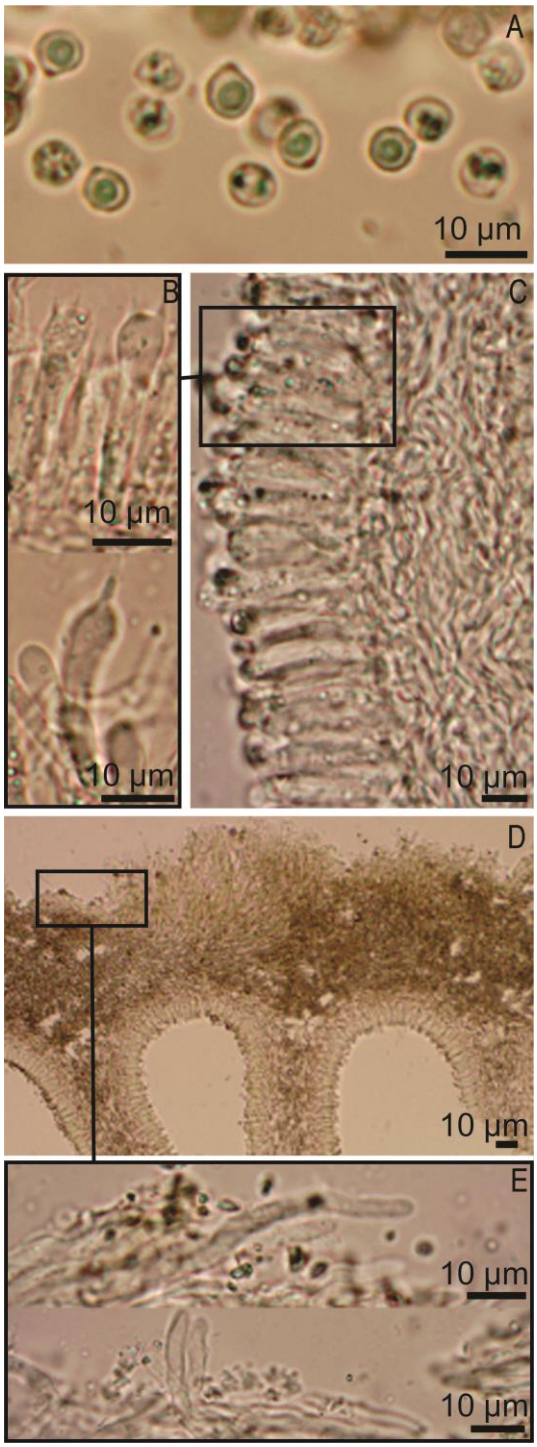

Fig. 3. *Clitocella pallescens*: **A** basidiospores. **B** basidia. **C** section of lamellar trama. **D** section of pileipellis, pileus and lamella trama. **E** Hyphae of the pileipellis. A-E, A. G. S. Silva-Filho 172 (HCP).

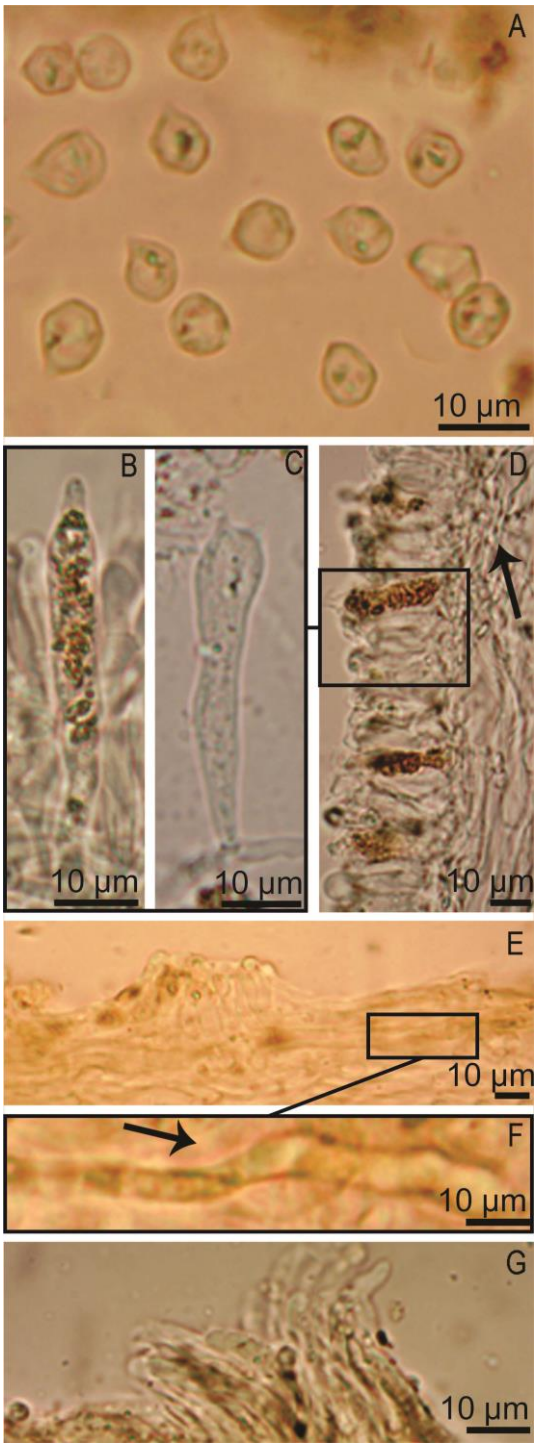

Fig. 4. *Rhodocybe caelatoidea*: **A.** basidiospores, **B.** pseudocystidia, **C.** basidium, **D.** section of lamellar trama and subhymenium, **E.** pileipellis, **F.** oleiferous hyphae of pileipellis, **G.** terminal hyphae of pileipellis. A-G, A. G. S. Silva-Filho 167 (HCP 1023).

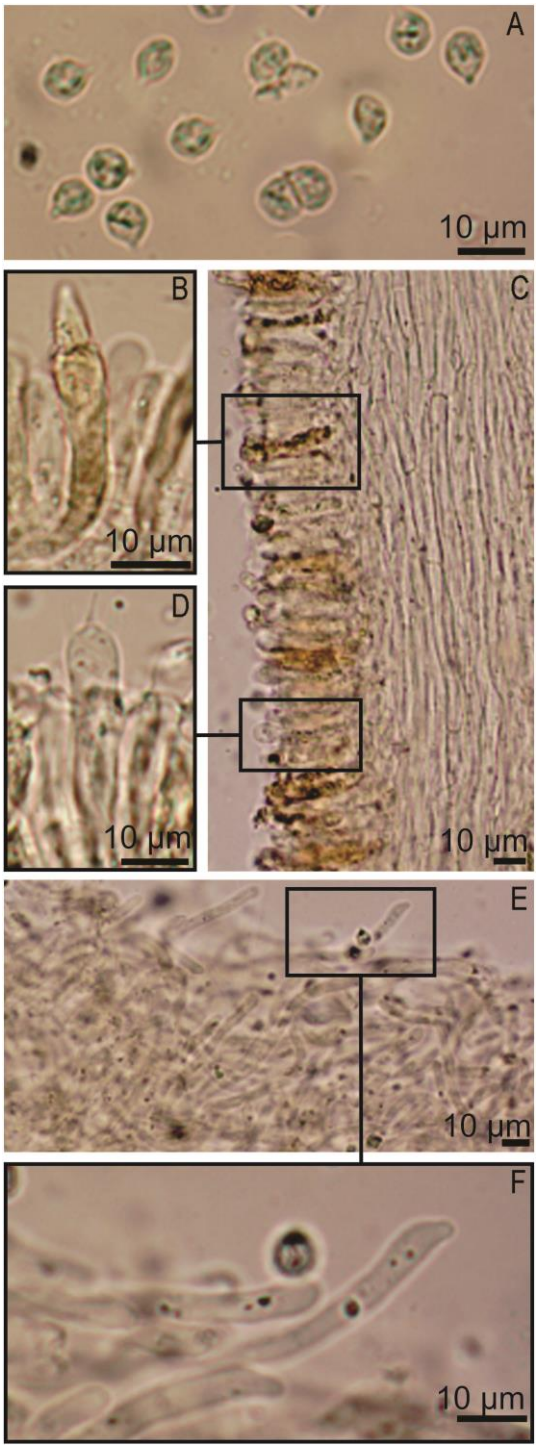

Fig. 5: *Rhodocybe galerinoides*: **A.** basidiospores, **B.** pseudocystidia, **C.** section of lamellar trama, **D.** basidium, **E.** pileipellis, **F.** terminal hyphae of the pileipellis. A-F, M. A. Teixeira-Silva 060 (HCP514).

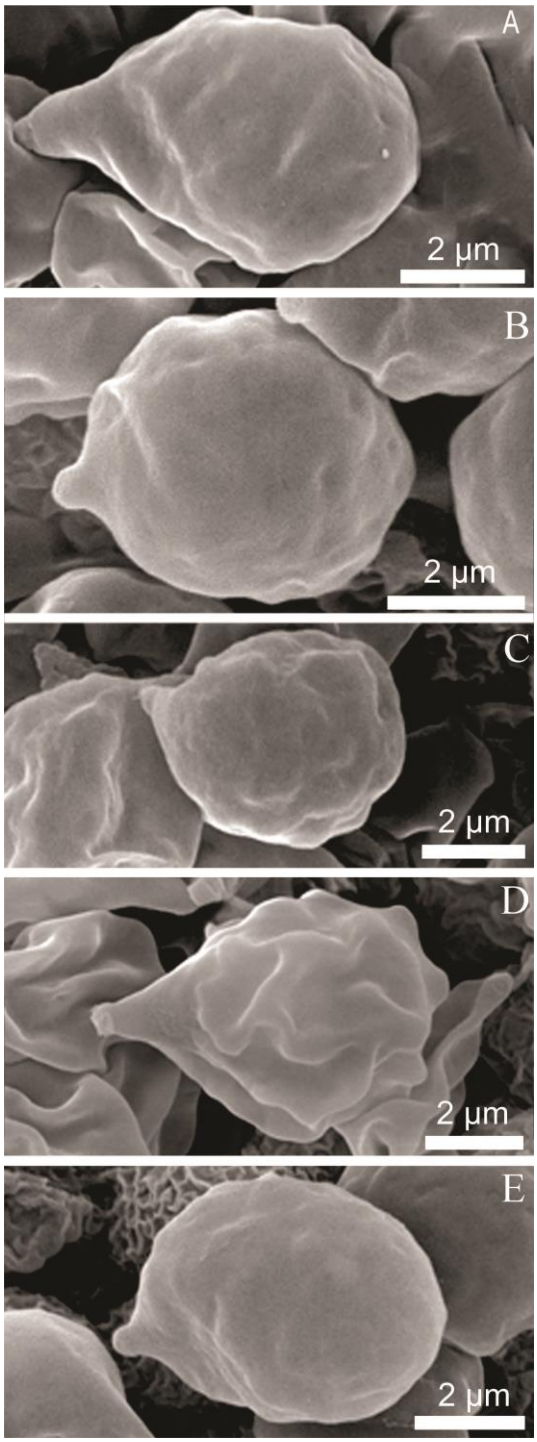

Fig. 6: SEM micrographs of the basidiospores: **A.** *Clitocella himantiigena*; **B-C.** *C. pallescens*; **D.** *Rhodocybe caelatoidea* whitout treatment; **E.** *R. galerinoides.* A, A. G. S. Silva-Filho 394, (HCP 1144); B and C, A. G. S. Silva-Filho 172 (HCP); D, A. G. S. Silva-Filho 167 (HCP 1023); E, M. A. Teixeira-Silva 060 (HCP514).

7 **Capitulo 4**: Artigo a ser submetido à Revista Acta Biológica Paranaense

Hohenbuehelia (*Pleurotaceae*) in western Paraná, Brazil

Hohenbuehelia (*Pleurotaceae*) no oeste do Paraná, Brasil

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VAGNER G. CORTEZ[2]

The genus *Hohenbuehelia* Schulzer is characterized by the pileus sessile, subsessile or with a lateral pseudostipe, rarely with a central stipe, gelatinized context, hyphae monomitic with clamp-connections, thick-walled metuloids, cheilocystidia of several shapes, especially fusiform with capitate apex (THORN & BARRON, 1986; CORNER, 1994). *Hohenbuehelia* comprises about 50 species widespread in the world (KIRK *et al*., 2008), but 180 names are recorded in Index Fungorum database (www. Indexfungorum.org), included synonyn related to pleurotoid's genus as *Resupinatus* Nees and *Tectella* Earle. Based on recent molecular phylogenetic research, *Hohenbuehelia*, previosly classified in *Tricholomataceae* R. Heim, *Polyporaceae* Fr. and *Pleurotaceae* Kühner, was confirm in the family *Pleurotaceae* (THORN *et al*., 2000).

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The assexual stage, *Nematoctonus* Drechsler, has been used for the biological control of plant-parasitc nematodes (THORN & BARRON, 1986). Some species are considered edible, but of little culinary value, especially due to reduced size of basidiomata, although some larger species as *H. petaloides* (Bull.) Schulzer even so consumed (GÁNDARA & CRUZ, 2005).

The genus has received little attention in Brazil, where 20 species are known, including nine species and one variety described after collections from Amazon and Atlantic Forest (SINGER 1989; CORNER 1994; PUTZKE, 1994; DE MEIJER, 2006). In Paraná State, DE MEIJER (2006; 2008) reported four species, three of uncertain identification and described a new one: *H. silvae-araucariae* de Meijer. All these reported species from Paraná are from Dense and Mixed Ombrophilous Forest, except *H.* cf. *portegna* (Speg.) Singer, also recorded from Seasonal Semideciduous Forests.

In this paper we report five *Hohenbuehelia* species from Seasonal Semideciduous Forest, western region of Paraná State, as part of ongoing survey of the Agaricales that occurs in this ecosystem (SILVA-FILHO *et al.* 2016).

MATERIAL AND METHODS

Specimens were collected from January to December 2015 in two localities: São Camilo State Park, (24°18’00”–24°19’30”S),

municipality of Palotina; RPPN Fazenda Açu (24°11'15.86"S–53°58'2.10"W), municipality of Terra Roxa. Both areas are fragments of Seasonal Semidecidual Forest, a typical vegetation at the Atlantic Forest Biome in western region of Paraná State (KOZERA & PELUCI, 2015). Morphological analysis (both macro- and microscopical) followed standard procedures for agaricoid fungi (SINGER, 1986). Color names and codes used in the macroscopical descriptions are based on Kornerup & Wanscher (1978); microscopic colors are based on potassium hydroxide (3-5% KOH) mounts, except when indicated. In the basidiospores description, Q is the quotient between the length and width, Q_m is the mean value of Q, and n is the number of measured basidiospores/analyzed basidiomata/collections. Microscopic photographs were made under an Olympus CX31 microscope with a Toup Cam FMA050 digital camera, and measurements were taken through software Toup tek Toup View. All specimens were housed at the Herbarium of Universidade Federal do Paraná, Campus Palotina (HCP).

TAXONOMY

Hohenbuehelia angustata (Berk.) Singer

Lilloa 22: 255 (1951)

Fig. 1A-H

Pileus 19 mm diam., dimidate to flabeliform, plane, surface smooth, margin slightly striate, lobed, eroded, greyish green (1C4) to greyish yellow (1B4), margin pale yellow (1A3) to yellowish white (1A2). Lamellae decurrent, crowded, with 3–4 sized lamellulae, margin serrate, concolorous with the side, white (1A1), yellowish withe (1A2). Context thin (1.5 mm), pale grey (1B1). Stipe lateral, 4.5 mm diam., compressed, smooth, inserted, greyish yellow (1B4) to yellowish white (1A2) (Fig. 1A).

Basidiospores 3.5–5 × 2.5–3.5 µm, Q= 1.29–1.92, Qm= 1.52 n= 25/1/1 subglobose to subellipsoid, smooth, thin-walled, gutulate, hyaline, inamyloid (Fig 1B). Basidia 14–15.5 × 3.5–4.5 µm, narrow-clavate to clavate, with four and two sterigmata, hyaline (Fig. 1C). Cheilocystidia 15–29 x 2–7.5 µm, lecythiform, clavate, ventricoso-capitulate, flexuous, thin-walled, fusiform, filiform, capitulum globose, oblong strangulate, with and without mucron at the apex, hyaline (Fig. 1F). Metuloid 18–60 x 7–17 µm, clavate, fusiform, ventricose-fusiform, lanceliform, non abudant, with incrustation at apex, some few incrusted, hyaline, on both edge and side, smaller at the edge (Fig. 1E). Pileipellis a gelatinized cutis of interwoven hyphae, 1.5–6 µm in wide, smooth and incrusted hyphae, thin-walled, hyaline (Fig 1F). Pileocystidia of two types: I) leptocystidia, 8–19 × 1.5–6.5 µm, filiform, ventricose-filiform,

some capitulate and with mucron at apex, scattered, thin-walled, hyaline (Fig 1F); II) metuloid, 29.5–79.5 × 5–9.5 µm, clavate to fusoid, inserted into the gelatinous layer, clinal and anticlinal arranged, thick-walled, 1.5–2 µm, scattered, some slightly incrusted at the apex, hyaline (Fig 1G). Pileus trama two layer: I) upper gelatinous layer, 97–137 µm thick, with horizontally arranged, smooth and slightly incrusted hyphae, 3–5.5 µm in wide, hyaline; II) under non-gelatinized layer, 29–50 µm thick, with interwoven, hyphae 2–4 µm in wide, smooth, hyaline. Lamellar trama subregular, non-gelatinized, thin-walled, with hyphae, 1.5–3.5 µm in wide, smooth, hyaline. Clamp-connection in all tissue.

EXAMINED SPECIMENS: BRAZIL: Paraná. Palotina, São Camilo State Park, 04/V/2015, A.G.S. Silva-Filho 352 HCP (1140).

HABITAT AND DISTRIBUTION: Solitary on decaying wood, in the forest. Known from North (COKER, 1944; THORN & BARRON, 1986), Central (GÁNDARA & CRUZ, 2005) and South America (SINGER & DIGILIO, 1951). In Brazil, this species is recorded from Atlantic Forest of Rio Grande do Sul and Paraná States (PUTZKE & CAVALCANTI, 1995; DE MEIJER 2006), and Amazonia Forest (CORNER, 1994). In Paraná State, DE MEIJER (2006) recorded this species only in Ombrophilous Mixed Forest, with *Araucaria angustifolia* (Bertol.) Kuntze.

DISCUSSION: Our materials exhibited the features described by SINGER & DIGILIO (1951), THORN & BARRON, (1986), CORNER (1994) and GÁNDARA & CRUZ (2005), and were identified based on the spathulate basidiomata, glabrous pale yellow pileus, crowed lamellae (Fig. 1A), subglobose to subellipsoid basidiospores (Fig. 1B) and scarce pileocystidia (Fig. 1H).

Hohenbuehelia testudo (Berk.) Pegler is a close species, whose limits with *H. angustata* are somewhat uncertain (THORN & BARRON, 1986). However, the pileus color, basidiospores size, and the metuloid pigment are features used to segregate these two species (PUTZKE & CAVALCANTI, 1995).

Hohenbuehelia bullulifera Singer

Lilloa 25: 119 (1951)

Fig. 2A-H

Pileus 4–20 mm diam., dimidiate to orbicular, conchate, surface smooth, dark grey (1F1), greysh brown (6F3), margin translucent striate, dark brown (6F4). Lamellae crowded, margin even, concolor with the sides, greyish brown (6F3) to dark brown (6F4). Context thin (<1 mm), concolor with the pileus. Pseudostipe 1–1.5 mm, compressed, smooth, inserted, without mycelial pad at insertion concolorous with pileus (Fig 2A–B).

Basidiospores 5–7 × 2.5–4 µm, Q= 1.45–2.03, Qm= 1.81, n=50/2/2, subellipsoid to ellipsoid, smooth, thin-walled containing 1 to 2 oil drop, hyaline, inamyloid (Fig 2C). Basidia 15–16 × 5.5–6 µm, narrow clavate to clavate, tetrasporic, hyaline. Cheilocystidia 12–19.5 × 7.5–11.5 µm, clavate, broadly clavate, vesiculose-pedicellate (Fig 2E), thin-walled, hyaline, some with crystal incrustation. Metuloid, 23.5–62 × 9.5–14.5 µm, lanceliform, ventricoso-fusiform, non-abundant, strongly incrusted with hyaline crystal at the apex, brown wall, 2.5–5 µm in wide, on both edge and side smaller at the lamellar edge, brownish (Fig 2D). Pileipellis a thin cutis of interwoven, smooth to slightly incrusted, thin-walled hyphae, 3–7 µm in wide, ligth brown (Fig 2F). Pileocystidia leptocystidial of two types: I) 11–20.5 × 10–16 µm cylindrical, cylindrical rostrate, pyriform, clavate, some with crystalline incrustations, hyaline (Fig 2–GH); II) 13–77 × 3–9 µm sphaeropendiculate, fusiform, fusiform with bifurcate apex, strangulated, some with irregular projections at the apex, some with crystal incrustation, hyaline and light brown (Fig 2G–H). Pileus trama a gelatinous layer, 304–330 µm thick, composed of interwoven hyphae, 1.5–3 µm in wide, horizontally arranged, smooth and slightly incrusted mixed, thin-walled, hyaline. Lamellar trama irregular gelatinized, with hyphae 1.5–3.5 µm in wide, thin-walled, smooth, hyaline. Clamp-connection in all tissue.

EXAMINED SPECIMENS: BRAZIL: Paraná. Palotina, São Camilo State Park, 01/VII/2015, A.G.S. Silva-Filho 528 (HCP). Terra Roxa, RPPN Fazenda Açu, 14/X/2015, A.G.S. Silva-Filho 623 (HCP).

HABITAT AND DISTRIBUTION: Solitary, on rotting wood, in the forest. Known from Argentina and Brazil (Singer & Digilio, 1951). In Brazil, known only from Rio Grande do Sul (Putzke & Cavalcanti, 1995) and from Mixed Ombrophilous Forest of Paraná (de Meijer 2006).

DISCUSSION: *Hohenbuehelia bullulifera* belongs in sect. *Nigricans*, which includes species with black lamellae (FAZIO & ALBERTÓ, 2001). The basidiospores size (Fig. 2A), cheilocystidia size, clavate to broad clavate, vesiculose-pedicellate (Fig. 2E) and presence of pileocystidia leptocystidial (Fig. 2H) without thick-walled pileocystidia are diagnostic features of this species (SINGER & DIGILIO, 1951). Our samples have cylindric to vesiculose-pedicellate pileocystidia. We noted even so pileocystidia sphaeropendiculate, fusiform, strangulated with crystal incrustation (Fig. 2H). The latter feature can be related with the developmental stage of the basidiomata; possibly younger specimens present sphaeropendiculate, fusiform, strangulated pileocystidia which become cylindrical and sparse in mature specimens.

Hohenbuehelia subbarbata (Berk. & M.A. Curtis) Singer from Cuba is another similar species, however is reported a white pruina on pseudostipe surface and the pileipellis does not have sphaeropendiculate, fusiform, strangulated pileocystidia (ALBERTÓ *et al.*,1998). Moreover, the cheilocystidia in *H. subbarbata* are exclusively metuloidal.

Hohenbuehelia singeri Albertó & Fazio from Argentina has smaller basidiomata (<5 mm diam.) with a pruinose pseudostipe, the basidiospores are smaller (4–5 × 3–3.5 µm), the pileipellis is composed a cutis of thin-walled and thick-walled hyphae without pileocystidia, and the metuloids are thin-walled with apical incrustation (ALBERTÓ *et al.*,1998).

Hohenbuehelia mastrucata (Fr.) Singer

Lilloa 22: 255 (1951)

Figure 3A–I

Pileus 2–20 mm diam., spatulate, flabeliform, dimidate, conchate, surface punctate-squamulose, margin non striate, enrolled in youngs basidiomata, lobed when mature, greysh brown (6D4), brownish grey (6C2, 6E2, 6F2), greyish grey (1D2, 1E2), olive brow (4E4–4E3) when young, light brown (6D4) with margin white (1A1) only when mature. Lamellae subdistat, margin smooth to slightly serrate, concolorous with the side, white (1A1) to pale grey (1B1). Context thin (1mm)

brown (5F7), greenish grey (1C2). Subestiptate, 2mm diam., compressed, surface smooth, concolorous with the pileus, white mycelial pad at insertion (Fig. 3A–B).
Basidiospores 7.5–9 × 3.5–5.5 µm Q= 1.37–2.16, Qm= 1.74, n= 40/3/3, subellipsoid to ellipsoid, thin-walled, some with an oil drop, hyaline, inamyloid (Fig. 3C). Basidia 17.5–32 × 5.5–9 µm, narrow-clavate to clavate, with four and two sterigmata, hyaline, some with bright content (Fig. 3E). Cheilocystidia 19–31 x 3.5–10.5 µm, lecythiform, broadly-clavate, capitate, rostrate, 1–2 rostri, capitulum globose, obpyriform with ring constriction, some with branched apex, hyaline (Fig. 3G). Metuloid 23.5–95 × 9.5–23.5 µm, ventricose-rostrate, ventricose-fusoid, abundant, incrusted with hyaline crystal at the apex, hyaline wall, 2–5 µm in wide, on both edge and side, smaller at the edge, hyaline (Fig. 3F). Pileipellis a cutis of subparallel hyphae, 4–12 µm in wide thin-walled, smooth and with brown incrustation mixed, hyaline, at some points forming a pyramidal gelatinous cutis of anticlinais hyphae (Fig. 3H). Pileocystidia 11–20 × 6.5–11.5 µm, clavate, fusoid, some septate, rares capitate with mucron, thin-walled, hyaline and some with brown content (Fig. 3I). Pileus trama one gelatinous layer, 308-580 µm thick, composed of interwoven hyphae, 1.9–4.4 µm wide, slightly to strongly incrusted, thin-walled, hyaline. Lamella trama irregular, with hyphae 4.5–8 µm in wide non-gelatinized, thin-walled, smooth,

hyaline, some with refringent content. Clamp-connection present in all tissue.

EXAMINED SPECIMENS: BRAZIL: Paraná. Palotina, São Camilo State Park, 19/I/2015, A.G.S. Silva-Filho 110 (HCP 1005); 02/III/2015, A.G.S. Silva-Filho 166 (HCP 1007); 16/III/2015, A.G.S. Silva-Filho 201 (HCP 1004); 20/V/2015, A.G.S. Silva-Filho 436 (HCP 1006). Terra Roxa, RPPN Fazenda Açu, 14/X/2015, A.G.S. Silva-Filho 613 (HCP 1002) and 614 (HCP 1003).

HABITAT AND DISTRIBUTION: Solitary, on rotten wood, in the forest. Known from Japan (MURATA, 1978), North (THORN & BARRON, 1986) and South America (SINGER & DIGILIO 1951). In Brazil, known from the Atlantic Forest of Rio Grande Sul (PUTZKE & CAVALCANTI, 1995). And now we recorded from the first time from Paraná State.

DISCUSSION: *Hohenbuehelia mastrucata* is a widespread species with some variation in morphological features as reported in the literature; we identified our samples in the sense of THORN & BARRON (1986). The punctate-squamulose pileus surface with brownish-grey to brownish-olive color (Fig. 3A-B), subellipsoid to ellipsoid basidiospores (Fig. 3C), ventricose-rostrate to ventricose-fusoid metuloids (Fig. 3F), presence of capitate pileocystidia with apical mucron (Fig. 3I) were features considered for identification of this species. However our

specimens were slightly smaller (2–20 mm) than those reported by THORN & BARRON (1986, 15–55 mm), SINGER & DIGILIO (1951, up to 60 mm) and COKER (1944, up to 105 mm). Also the cheilocystidia (Fig 3G) are wider (9.5–23.5 µm) if compared to description by THORN & BARRON (1986, 4.5–7 µm in wide). These differences may be related with climatic, developmental stages or substrate differences and future molecular studies comparing sample collections from North and South America are needed to better understand such morphological variations.

Hohenbuehelia paraguayensis (Speg.) Singer

Lilloa 25: 467 (1952)

≡*Pleurotus paraguayensis* Speg., Anal. Mus. Nac. Hist. Nat. B. Aires 31: 359 (1922)

Figure 4A–F

Pileus 4–31 mm diam., dimidiate to flabeliform, conchate, convex, sligtly umbonated, surface smooth near the insertion, hirsute to pubescent towards the margin, sometimes scrobiculate, slightly velutinous at the margin, margin striate, slightly lobed, involut, brownish grey (5C2–5D2), greyish brown (6E3), brown (6E5) to light brown (5D4), margin discolor white (1A1). Lamellae crowded to subdistant with 2–4 sized lamellulae, margin even to serrate, concolor with the sides, white (1A1). Context thin (1.5–3mm), white (1A1). Stipe absent

with mycelial pad and white rhizomorphs at insertion (Fig. 4A–B).

Basidiospores 5.5–9.5 × 3.5–5.5 µm, Q= 1.44–2.45, Qm= 1.78, n= 65/3/3, subellipsoid to ellipsoid, smooth, gutulat, thin-walled, hyaline inamyloid (Fig. 4C). Basidia 19–24 × 4.5–6 µm, clavate, with four and two sterigmata, hyaline, some with bright elements. Cheilocystidia 17–31 × 2.5–10.5 µm, lecythiform, rostrate, capitate, with 1–2 rostri, capitulum globose, obpyriform, oblong with ring constriction, hyaline (Fig. 4D). Metuloids 41–109 × 10–25 µm, fusoid-ventricose, ventricose-rostrate, lanceolate, numerous, incrusted with crystal at the apex, hyaline wall, 1.5–4.5 µm thick, hyaline, present on both edge and side, a little smaller at the edge (Fig. 4E). Pileipellis a cutis of interwoven hyphae, 2–14.5 µm wide, smooth and incrusted, thin-walled, some with crystal incrustation, hyaline, in some parts forming semi-erect hyphae with clavate, broadly-clavate, clavate-papillate and fusoid terminal elements, 15.5–36.5 x 4.5–12 µm, thin-walled, hyaline (Fig. 4F). Pileocystidia absent. Pileus trama composed for interwoven gelatinous layer, 83–150 µm thick, with hyphae 1.5–5 µm in wide, smooth and slightly incrusted, hyaline, some with refrigent content. Lamellar trama subregular, non-gelatinized, with inflated hyphae 3.5–23 µm in wide thin-walled, smooth hyaline. Rhizomorphs with subregular

hyphae, 2–6.5 µm in wide, slightly incrusted, with refringent content. Clamp-connection not visualized on the lamella trama.

EXAMINED SPECIMENS: BRAZIL: Paraná. Palotina, São Camilo State Park, 2/III/2015, A.G.S. Silva Filho 165 (HCP 1009); 13/IV/2015, A.G.S. Silva-Filho 256 (HCP 1008); 27/VII/2015, A.G.S. Silva-Filho 581(HCP 1010).

HABITAT AND DISTRIBUTION: Solitary, on decaying wood, in the forest. Known from USA (SINGER & DIGILIO, 1951), México (GÁNDARA & CRUZ, 2005), Argentina and Paraguay (SINGER, 1951). In Brazil the species is known from Atlantic Forest of Rio Grande do Sul (PUTZKE & CAVALCANTI, 1995) and Paraná (DE MEIJER 2006) States. In Paraná, DE MEIJER (2006) reported it from Ombrophilous Mixed Forest.

DISCUSSION: The small basidiomata with surface smooth to slightly squarrose, striate margin, brown to light brown color with discolor margin (Figs. 4A–B) are features that help a field identification of thus species. Microscopically, the oblong to cylindrical basidiospores (Fig 4C), the size of metuloids (Fig 4E) and cheilocystidia (Fig 4D) are diagnostic features of the species (Singer, 1951). Our specimens agree with descriptions of Singer & Digilio (1951) and Gándara & Cruz (2005). We noted the presence of rhizomorphs only in one sample collection.

Our specimens of *Hohenbuehelia paraguayensis* and *H. mastrucata* are microscopically similar. Both have basidiospores, metuloids and cheilocystidia with similar format and size, but the pileipellis in *H. paraguayensis* is a cutis with crystal-incrusted hyphae, without pileocystidia, forming scattered points with semi-erect hyphae, while *H. mastrucata* does not has crystal incrustation at cutis' hyphae, possesses pileocystidia and form a pyramidal gelatinous cutis of anticlinal hyphae. Macroscopically, *H. paraguayensis* has pileus with light-brownish coloring with discolor and striated margin, surface smooth at insertion and hirsute to pubescent near the margin, while *H. mastrucata* has pileus with olive-brownish coloring, margin non striated and surface punctate-squamulose. The pileus surface and darker pileus color segregate *H. paraguayensis* from *H. phalligera* (Mont.) Singer, which also lacks capitate cheilocystidia (Putzke & Cavalcanti, 1995).

Hohenbuehelia portegna

(Speg.) Singer, Lilloa 22: 256 (1951)

≡*Agaricus portegnus* Speg., Anal. Soc. Cient. Argent. 12: 15 (1881)

≡*H. atrocaerulea* f. *portegna* (Speg.) Singer, Lilloa 25: 112 (1952)

Figure 5A–H

Pileus 18–22 mm diam., convex, dimidiate, conchate, surface smooth, tomentose to hirsute at insertion point, brown (7E4), greyish brown (7D3), brownish grey (5C2) at the center,

discolor at the margin, which is pastel grey (1A3), white (1A1) to pale grey (1B1), slightly striate, some lobed. Lamellae crowded to subdistant, with 2–3 sized lamellulae, margin even to slightly wave, concolorous with the side, white (1A1) to pale grey (1B1). Stipe absent. Context thin (2–3mm), light brown (5D5) to white (1A1) (Fig. 5A–B).

Basidiospores 7–11.5 × 3–5 µm, Q= 1.88–2.42, Qm= 2.17, n= 25/1/1, ellipsoid, smooth, thin-walled, hyaline, with refringent content, hyaline, inamyloid (Fig. 5C). Basidia 17–28.5 × 5–7.5 µm narrow clavate, to clavate, with one, two or mostly four sterigmata, hyaline, some with refrigent content. Cheilocystidia 14–32 x 4–13 µm, thin-walled, lecythiform, fusiform, short clavate, capitulate, capitulum globose, oblong, some with branched apex, hyaline (Fig. 5D). Metuloids 20–96 × 7.5–21 µm, ventricose-fusoid, clavate, lanceolate, bearing crystalline incrustation at the apex, some non-incrusted, walls hyaline, 2.5–5.3 µm wide, hyaline, on both edge and side, smaller at the edge(Fig. 5E). Pileipellis a cutis of interwoven hyphae, 3–9.5 µm in wide, smooth to some brown incrusted (Fig. 5F), hyaline and light brown in groups, thin-walled, rarely thick-walled, 1–3 µm diam., giving rise to narrow and conical of erect hairs 64–238 × 3–5 µm, hyaline (Fig. 5F). Pileocystidia rare, 35–50 × 5–9 µm, ampullaceous to subcapitate, thin-walled, hyaline (Fig. 5G). Pileus trama two layered: I) upper gelatinous layer, 500–962 µm

thick, with erected hyphae, 1.5–4 µm wide, incrusted or smooth, thin-walled, hyaline; II) lower non-gelatinized layer, 100–156 µm thick, with interwoven hyphae 1.5–6 µm, smooth, thick-walled, 1–2.5 µm, hyaline. Lamella trama subregular, slightly gelatinized with hyphae, 3–6.5 µm wide, thick-walled (Fig. 5H), 1–3 µm, smooth, hyaline. Clamp-connections present in all tissue.

EXAMINED SPECIMENS: BRAZIL: Paraná. Terra Roxa, RPPN Fazenda Açu, 06/VI/2015, A.G.S. Silva-Filho 461 (HCP 1139); 23/VI/2015, A.G.S. Silva-Filho 631 HCP (1031).

HABITAT AND DISTRIBUTION: Solitary on decaying wood, in the forest. Known from Argentina (SINGER & DIGILIO, 1951; RAITHELHUBER, 1991) and Brazil, from the Atlantic Forest of São Paulo (PEGLER, 1997), Paraná (DE MEIJER, 2006) and Rio Grande do Sul States (PUTZKE & CAVALCANTI, 1995).

DISCUSSION: *Hohenbuehelia portegna* is recognized by the pileus size and color, with tomentose to hirsute surface, margin slightly striate and discolor (Figs. 5A-B), basidiospores size (Fig. 5C), cheilocystidia lecythiform, fusiform, short clavate and capitulate (Figs. 5D), and the erect hairs in the pileipellis (Figs. 5F). We noted in our samples some thick-walled hyphae in the lamella trama (Fig. 5H), which were not reported by SINGER & DIGILIO (1951) and SINGER & KUTHAN (1980). The variation in pileus color is due to developmental stage, which becomes paler

in age, as also observed in *H. mastrucata* specimens. Morphologically, it is very similar to *H. atrocaerulea* (Fr.) Singer, and was considered by SINGER & DIGILIO (1951) as a variety of this species, however SINGER & KUTHAN (1980) distinguished both species mainly by basidiospores size. SINGER (1975) suggested that *H. portegna* thus far known only from the temperate zones of South America, while *H. atrocaerulea* is distributed in the Northern Hemisphere.

ABSTRACT

A survey of *Hohenbuehelia* in Seasonal Semideciduous Forests from the Western Paraná State in South Brazil, resulted in the identification of five species: *H. angustata, H. bullulifera, H. mastrucata, H. paraguayensis* and *H. portegna*. All these are described and illustrated. *Hohenbuehelia mastrucata* is a new record from Paraná State.

KEY WORDS: Agaricales, Atlantic forest, pleurotoid fungi, taxonomy

RESUMO

No levantamento das *Hohenbuehelia* em áreas de Floresta Estacional Semidecidual no oeste do Paraná, cinco espécies foram identificadas: *H. angustata, H. bullulifera, H. mastrucata, H. paraguayensis* e *H. portegna*. Todas espécies são descritas e

ilustradas. *Hohenbuehelia mastrucata* é uma nova citação para o Paraná.

PALAVRAS-CHAVE: Agaricales, Floresta Atlântica, fungos pleurotoides, taxonomia

RÈSUMÉ

Dans l'étude des *Hohenbuehelia* des forêts saisonnières de l'ouest du Paraná, au sud du Brésil, cinq espèces ont été identifiées: *H. angustata, H. bullulifera, H. mastrucata, H. paraguayensis* et *H. portegna*. Toutes ces espèces sont décrites et illustrées. *Hohenbuehelia mastrucata* est un nouveau record de l'État du Paraná.

MOTS-CLÉS: Agaricales, Forêt atlantique, champignons pleurotoides, taxonomie

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Fig. 1. *Hohenbuehelia angustata*: A, Basidiomata. B, Metuloid. C, Basidiospores. D, Basidia. E, Cheilocystidia. F, Pileipellis with thin-walled pileocystidia. G. Pileipellis with thick-walled pileocystidia. Scale bar: A-B, 5 mm. B-H, 10µm. All from *A.G.S. Silva-Filho* 352.

Fig. 2. *Hohenbuehelia bullulifera*: A-B, Basidiomata. C, Basidiospores. D, Metuloid. E, Cheilocystidia. F-G, Pileipellis. H, Pileocystidia. Scale bar. A-B, 5 mm. C-H, 10 µm. All from *A.G.S. Silva-Filho* 528.

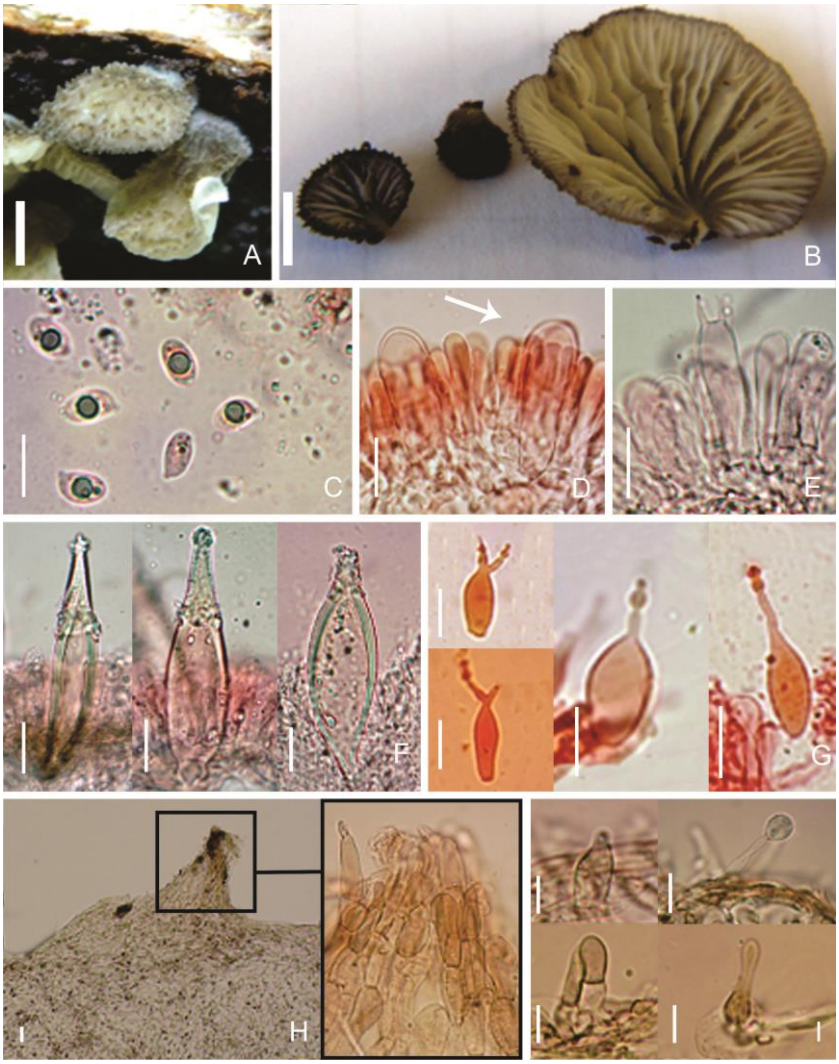

Fig. 3. *Hohenbuehelia mastrucata*: A-B, Basidiomata, C, Basidiospores, D, Hymenium with thin-walled pleurocystidia, E, Basidium. F, Metuloid. G, Cheilocystidia. H, Pileipellis and context hyphae, showing semi-erect hyphae with clavate terminal elements. I, Pileocystidia. Scale bar: A-B. 5 mm, C-I 10 µm. All from *A.G.S. Silva-Filho* 614.

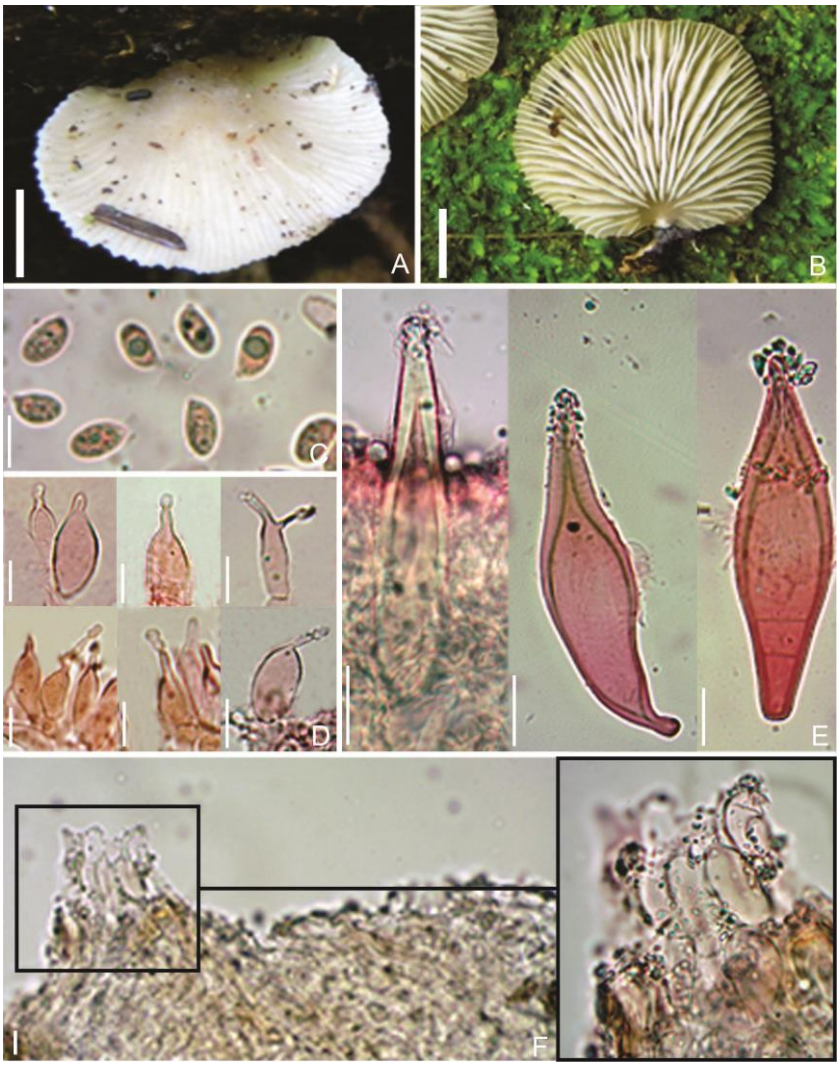

Fig. 4. *Hohenbuehelia paraguayensis* A-B, Basidiomata, C, Basidiospores, D, Cheilocystidia. E, Metuloid. F, Pileipellis and context, showing semi-erect hyphae with crystals incrusted on clavate terminal elements. Scale bar: A-B. 5 mm, C-F 10 µm. All from *A.G.S. Silva-Filho* 256.

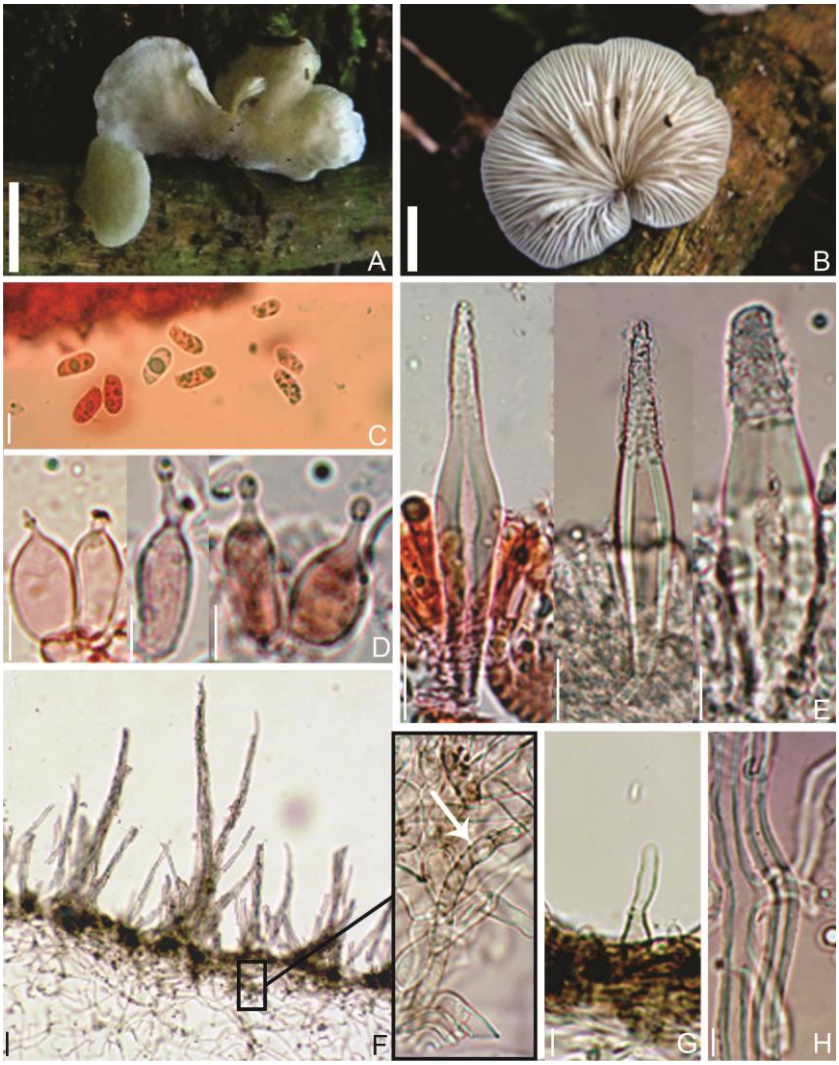

Fig. 5. *Hohenbuehelia portegna* A-B, Basidiomata, C, Basidiospores, D, Cheilocystidia. E, Metuloid. F, Pileipellis and context hyphae, showing incrusted brown hyphae. G, Pileocystidia. H, Lamella trama hyphae with thick walls. Scale bar: A-B. 5 mm, C-G 10 µm. All from *A.G.S. Silva-Filho* 631.

8 **Capitulo 5**: Artigo a ser submetido à Revista Rodriguésia

Crepidotus and _Simocybe_ (_Crepidotaceae_) from Seasonal Semidecidual Forests of Paraná State, Brazil

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Resumo: *Crepidotus crocophyllus*, *C. mexicanus* e *Simocybe tucumana* foram identificados como resultado de um levantamento de fungos agaricoides em fragmentos de Floresta Estacional Semidecidual no oeste do Paraná, sul do Brasil. Todas as espécies são novos registros para esse ecossistema, *C. crocophyllus* é citada pela primeira vez para o estado do Paraná e *C. mexicanus* é registrado pela primeira vez para a América do Sul. São fornecidas descrições, ilustrações macro- e microscópicas, imagens de microscopia eletrônica de varredura dos basidiósporos, além de discussão taxonômica e de distribuição geográfica.

Palavras chave: Agaricomycetes, biodiversidade, Floresta Atlântica, novos registros

Abstract: *Crepidotus crocophyllus*, *C. mexicanus* and *Simocybe tucumana* were identified in a survey of agaricoid fungi from Seasonal Semideciduous Forests of Western Paraná State, in South Brazil. All species are new records from this ecosystem, and *C. crocophyllus* is new from Paraná State and *C. mexicanus* is reported for the first time to for South America. Detailed macro- and microscopic descriptions and illustrations are presented for all species, including scamnning electron microscopy of the basidiospores, as well as a brief discussion on their taxonomy and geographical distribution.

Key world: Agaricomycetes, Atlantic Forest, biodiversity, new records

Introduction

Crepidotaceae, in the sense of Singer (1986), includes a heterogeneous group of mostly pleurotoid, but also collybioid and omphalinoid fungi, producing pip-shaped, ellipsoid, or globose basidiospores without germ pore, producing a pale yellow to dark-brown spore-print (Aime *et al.* 2005). Recent phylogenetic studies placed the genera *Crepidotus* (Fr.) Staude, *Episphaeria* Donk, *Inocybe* (Fr.) Fr., *Neopaxillus* Singer, *Pleuroflammula* Singer, and *Simocybe* P. Karst. in the core of this family, although some of these were previously classified in other families (Petersen *et al.* 2010; Vizzini *et al*. 2012; Watling & Aime 2013). Currently, species of *Crepidotus*, *Inocybe*, *Neopaxillus*, *Pleuroflammula* and *Simocybe* are known in Brazilian mycobiota.

*Crepidotu*s has been studied in Brazil by Singer (1973, 1989), and recent investigations described new species and records from Rio Grande do Sul (Pereira 1990), Paraná (Senn-Irlet & de Meijer 1998) and São Paulo (Capelari 2007) States. *Simocybe* is a poorly known genus, which only *S. tucumana* Singer (de Meijer 2006) and others two identified species, *S.* aff. *alachuana* (Murrill) Singer, and *S.* cf. *semiglobata* (Murrill) Singer, is know from Brazil, all from Paraná State. *Neopaxillus echinospermus* (Speg.) Singer is the only species known of the genus in Brazil and is distributed along the Neotropical zone, including the forests of Paraná State (Silva-Filho *et al*. 2016). *Inocybe* has been reported from all Brazilian regions, and includes both native and exotic species (Wartchow *et al*. 2008). The small genus *Pleuroflammula* is represented in the country only by *P. fluminensis* Singer, which Horak (1978) considered a doubtful due to lack of preserved material. Members of *Episphaeria* are have been not reported from Brazil.

In a survey of the mycobiota from the Seasonal Semidecidual Forest of western Paraná State, members of *Crepidotus* and *Simocybe* were collected, and the results are presented as follows.

Material and methods

Basidiomes of agarics were collected in the following: a) Parque Estadual São Camilo, municipality of Palotina (24°18'34.23"S; 53°54'22.24"W); b) Universidade Federal do Paraná, Campus Palotina (24°17'35.96"S; 53°50'30.19"W); and c) Reserva Particular do Patrimônio Natural Fazenda Açu, municipality of Terra Roxa (24°11'56.25"S; 53°57'55.39"W). All comprise fragments of Seasonal Semidecidual Forest (Atlantic Forest Biome) in the western region of Paraná State. Morphological analysis, macro- and microscopical, followed standard procedures for agaricoid fungi (Largent *et al*. 1977; Largent 1986). Colour names and codes used in the macroscopic descriptions are from Kornerup & Wanscher (1978); colors for microscopic features are noted from 3% KOH mounts. Micrographs were taken from an Olympus CX31 optical microscope with a Toup Cam FMA050 digital camera, and the measurements were taken through software Toup tek Toup View. In the basidiospores description, Q is the quotient between the length and width, Qm is the medium value of Q and n is the number of measured basidiospores/number of analyzed basidiomata/number of collections. Scanning electron micrographs (SEM) were performed at the Center of Electron Microscopy of the Universidade Federal do Paraná (CME/UFPR), Curitiba, under a Jeol JSM-6360LV scanning electron microscope. All specimens were dried in an open air drier (±40ºC) and are preserved at the mycological collection at the Herbário do Campus Palotina (HCP).

Results and Discussion

Crepidotus crocophyllus (Berk.) Sacc., Syll. Fung. 5: 886 (1887).

≡ *Agaricus crocophyllus* Berk., London J. Bot. 6: 313 (1847)

Figs. 1a, 2a-e, 5a

Pileus 17–39 mm diam., dimidiate to flabeliform, convex to broadly convex, surface fibrillose to appressed squamulose, sometimes smooth, margin slightly involute, non-striate to slightly translucent striated (Fig. 1a), pastel yellow (3A4) to dull yellow (3B4) with yellowish brown (5D5) to brown (5EF) squamulose. Context thin, up to 2 mm thickness, white (1A1), fleshy. Lamellae subdistant with 3-sized lamellulae, margin smooth to slightly serrate, concolor with the sides (Fig. 1a), yellowish white (1A2) to orange grey (5B2). Stipe absent, but in some basidiomata a white (1A1) mycelial pad attachment can be noted. Spore print not obtained.

Basidiospores 5–6.5(–7) × 5–6.5(–7) µm, Q= 1–1.09, Qm= 1.02, n=33/3/4, mostly globose to subglobose, spinulose to spinulose-verruculose, thick-walled, reddish brown to orange (Fig. 2a); under SEM the ornamentation is baculate, formed of short to longer cylindrical spines (Fig. 5a). Basidia 19–32 × 6.5–8 µm, clavate, tetrasporic, hyaline, some with granular content. Pleurocystidia absent. Cheilocystidia 36–64.5(–78) × 4.5–7(–8) µm, crowded in the gill margin, cylindrical, clavate, flexuous, some catenulate, thin-walled, hyaline to pale yellowish (Fig. 2B). Pileipellis a cutis with interwoven hyphae, 6–16 µm diam., (Fig. 2c), with cylindrical terminal hyphae, some rare anticlinal arranged (Fig. 2e), clamped, brownish incrusted (Fig 2d), some smooth, hyaline and with brownish content. Pileus trama composed of spaced and interwoven hyphae, 5–18 µm diam., smooth and hyaline. Lamellae trama with parallel hyphae 3–5.5 µm diam., smooth and hyaline. Lamellae edge sterile. Clamp-connection present in all tissue.

Examined specimens: BRAZIL. PARANÁ: Palotina, P.E. São Camilo, 30.IX.2010, *A.J. Ferreira & R.L. Dias 8-6* (HCP 365); 24.VI.2015, *A.G.S. Silva-Filho 792* (HCP 1155); Campus UFPR, 10.XI.2015, *C. Bottke 04* (HCP 1156).

Habitat and distribution: Solitary on dead wood, in the forest. Known from Europe and Americas (Bandala *et al.* 2008). In Brazil, reported from Rio Grande do Sul (Pereira 1990) and now from Paraná States.

Notes: *Crepidotus crocophyllus* is a reported species from Europe, with a wide distribution in temperate zone (Ripková *et al.* 2005), and widespread in the Americas (Bandala *et al.* 2008). Based on morphological features, Bandala *et al.* (2008) analyzed fresh specimens from Costa Rica and México, and re-examined seven related species of subsection *Fulvifibrillosi sensu* Hesler & Smith (1965), thus proposing *C. appalachianensis* Hesler & A.H. Sm., *C. aureifolius* Hesler & A.H. Sm., *C. distortus* Hesler & A.H. Sm., *C. subaureifolius* Hesler & A.H. Sm., and *C. subnidulans* Hesler & A.H. Sm. as synonyms of *C. crocophyllus*. According to Bandala *et al.* (2008), small macro- and microscopic variations, as pileus surface and hymenophore colors, are common in *C. crocophyllus* and only reflect different stages of development. *Crepidotus nephrodes* (Berk. & M.A. Curtis) Sacc., from North America, also has been included as synonym of *C. crocophyllus* after detailed morphological and phylogenetic analysis by Ripková *et al.* (2005) and Bandala *et al.* (2008). From all our collections, only one studied materials presented a variation in pileus surface and hymenophore color, as above mentioned, but diagnostic microscopical data proposed by Bandala *et al.* (2008), as globose and spinulose-verruculose basidiospores, clavate or subclavate cheilocystidia, and pileipellis formed of repent, yellow to brown-pigmented, often incrusted hyphae, supported identification as *C. crocophyllus*. In addition, the shape of cheilocystidia is variable in format and Bandala *et al.* (2008) describle the cheilocystidia as "clavate, narrowly clavate or subclavate to more or less narrowly utriform or narrowly lageniform, at times subcylindric, somewhat flexuous or constricted with apex, rounded, subcapitate, rarely tapered or branched". The Argentinean and Brazilian collections by Singer (1973) and Pereira (1990) respectively, described the cheilocystia as "cylindrical to narrow ventricose and more or less constricted, or clavate, often capitate, rarely fusoid, unlike our specimens that has only cylindric, flexuous-clavate", similar the collection H. Beach 28 (Holotype of *C. subaureifolius*, Hesler & Smith 1965) also ilustrated by Bandala *et al.* 2008).

Crepidotus mexicanus Singer, Beih. Nova Hedwigia 44: 479 (1973)

Figs. 1b, 3a-d, 5b

Pileus 10–21 mm diam., dimidiate, convex to broadly-convex, surface smooth to slightly fibrillose, margin enrolled, smooth to slightly striatulate (Fig. 1b), white (1A1) to reddish brown (5C3). Context thin (< 1 mm thick), white (1A1), consistency fleshy. Lamellae sub-distant with 2 to 3-sized lamellulae, margin slightly wavy, slightly pilose view under the stereomicroscope, concolor with the sides (Fig. 1b), greyish orange (5B3). Stipe minute, inconspicuous, adpressed, concolor with the pileus, gelatinous mycelial pad on stipe attachment. Spore print not obtained.

Basidiospores 5–6 × 4–5 µm, Q= 1.17–1.55, Qm= 1.30, n=30/2/1, oblong to short ellipsoid, verrucose, slightly thick-walled, with suprahilar depression, reddish brown to orange (Fig. 3a), Under SEM the ornamentation consists of hemispheric, to truncate verrucae at some point looks like a reticule (Fig. 5b). Basidia 17–26 × 5–7 µm, tetrasporic, hyaline and some with granular content. Pleurocystidia absent. Cheilocystidia 22.5–40(–50) × 6.5–13 µm, lageniform, utriform rarely digitate, thin-walled, hyaline (Fig. 3b). Pileipellis a cutis with interwoven hyphae, 3.5–10 µm diam., with filiform to cylindrical terminal hyphae, clamped, smooth, hyaline (Figs. 3c,d). Pileocystidia not observed. Pileus trama with interwoven hyphae 1.5–6.5 µm diam., smooth and hyaline. Lamellae trama composed of interwoven hyphae, 2–4.5 µm diam., smooth and hyaline. Lamellae edge sterille. Clamp-connection present in all tissue.

Examined specimens: BRAZIL. PARANÁ: Palotina, P.E. de São Camilo, 15.XII.2015, *A.G.S. Silva-Filho* 742 (HCP 1190).

Habitat and distribution: In the forest, solitary, on dead wood. Known only from Mexico (Singer 1973) and now from Brazil.

Notes: *Crepidotus mexicanus* was described by Singer (1973) based on a collection of Mexico and, up to now it was the only known material for this species. Thus, we expand the known of distribution this species, from Mexico to Atlantic Forest of southern Brazil. The non-homogeneous basidiospore wall and the presence of clamp-connection places *C. mexicanus* in *Crepidotus* Sect. *Echinospori S*ubsect. *Porpophorini* sensu Singer (1973). Macroscopically, the Brazilian collection has some slightly variations compared with Mexican type. Singer (1973) described their specimens with white pileus at first, stipe becoming inconspicuous in mature specimens, and with abundant white mycelial tomentum. The pileus color in our collection is white to reddish-brown and was observed a gelatinous mycelial pad at stipe. These differences may be result of the environmental or geographical conditions or also of development stage as mentioned above in species of *C. crocophyllus*. The "dermatocystidia" reported by Singer (1973) in original description could not be observed. However, by virtue that most relevant taxonomic features, especially the basidiospore morphology and size, cystidia and pileipellis structure, we close the Mexican species with the collected by us and we identify as *C. mexicanus*.

Simocybe tucumana Singer, Sydowia 15(1-6): 72 (1962)

≡ *Simocybe junquillea* var. *tucumana* (Singer) Raithelh., Nueva Fl. Micol. Argent.: 289 (2004)

Figs. 1c, 4a-d, 5c

Píleus 3–22 mm., convex at first and broadly convex to plane when mature, velutinous at first then becoming smooth when mature, margin conspicuously striate, then sulcate when mature (Fig. 1c), yellowish brown (5D5) to light brown (5D8). Context thin (1.5–2 mm thick), pale grey (1B1), consistency fleshy. Lamellae adnexed to sinuate adnexed, close to sub-distant, with 3-sezed lamellulae, margin even to slightly crenate, concolor with the sides (Fig. 1c),

yellowish brown (5D5–5E7). Stipe 4–7 × 1.5–3 mm, eccentric, cylindrical, equal, pale orange (5A3), light orange (5A4), surface velutinous, fistulose, inserted base, some with white mycelial pad. Spore print brown (5E8).

Basidiospores 5.5–7 × 4–5.5 µm, Q= 1.22–1.51, Qm= 1.39, n=30/4/2, ovoid, oblong to short ellipsoid, smooth, moderately thick-walled, light orange to reddish brown (Fig. 4a), under SEM without ornamentation. Basidia 17–23.5(–27) × 5–6.5 µm, tetrasporic, hyaline. Cheilocystidia 19–42 × 6–14.5 µm, clavate, thin-walled, some catenulate, clamped at base, hyaline (Fig. 4b). Pleurocystidia absent. Pileipellis an enterocutis with interwoven hyphae, 2.5–11 µm diam., smooth and brownish incrusted, some with slightly thickened walls, hyaline or rarely with brownish content (Fig. 4d). Pileocystidia scattered or in small groups/fascicles, 21.5–36 × 8.5–14 µm, similar to the cheilocystidia (Fig. 4d). Pileus trama composed of interwoven hyphae, 5–11 µm diam., smooth and hyaline. Lamellae trama composed of parallel and inflated hyphae, 7–15 µm diam., smooth and hyaline. Lamellae edge fertile with acattered basidium. Stipitipellis a cutis with parallel hyphae, 2–5 µm diam., smooth, hyaline. Stipititrama with parallel hyphae 4.8–7.5 µm diam., smooth and hyaline. Caulocystidia (11)19–49.5(–57) × 8–12.5(–15.5) µm, also similar to the cheilocystidia in shape, some catenulate (Fig. 4c). Clamp-connection in all tissue.

Examined Specimens: BRASIL. PARANÁ: Palotina, UFPR, 11.XI.2015, *C. Bottke* 04 (HCP 1158); 21.VI.2016, *C. Bottke* 23 (HCP 1159).

Habitat and distribution: In the board of forest trail on vine of *Convolvulaceae* Juss. Known only from Argentina (Singer 1973) and Brazil (de Meijer 2006, 2016).

Notes: *Simocybe tucumana* was originally described by Singer (1962) from Argentina and later recorded in Mixed Ombrophilous Forest of Paraná State (de Meijer 2006), and in ecotone area (Atlantic Forest and Cerrado) in the State of São Paulo (de Meijer 2016). In both Brazilian reports a complete description of such collections is not presented; thus, this is the

first report describing Brazilian collections and the first record from the Seasonal Semideciduous Forest.

Singer (1973) presented a key for the Neotropical *Simocybe* species, where *S. tucumana* is separated from the other members in the genus due to combination of the following features: pileus (≥7 mm), stipe eccentric, yellowish beige color, basidiospores with the inner side mostly less concave than the other side or even entirely applanate, and broad cheilocystidia (7–14 µm diam.); all these features are noted in our specimens from Seasonal Semideciduous Forest and match the original description. Singer (1962, 1973) and de Meijer (2006, 2016) reported this species growing on wood of dicotyledonous trees, but our materials from western Paraná were found on decomposing and parasitizing vine's species of *Convolvulaceae*.

Acording to Singer (1973) *S. tucumana* is related to *S. fulvifibrillosa* (Murrill) Singer (from Mexico) and *S. junquillea* Singer (from Argentina). Both species share similar morphology: pileus size, absence of olivaceous shades, eccentric stipe, and broad cheilocystidia; however, *S. fulvifibrillosa* has pileus surface with conspicuous imbricate tufts of brownish fibrils, stipe white and larger basidiospores (6.3–8.3 × 4.5–5.7 µm) and *S. junquillea* also present a white stipe, larger basidiospores (6–8.5 × 4–7.6 µm) and clavate-capitate cheilocystidia (Singer 1973).

Acknowledgements

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Figure captions:

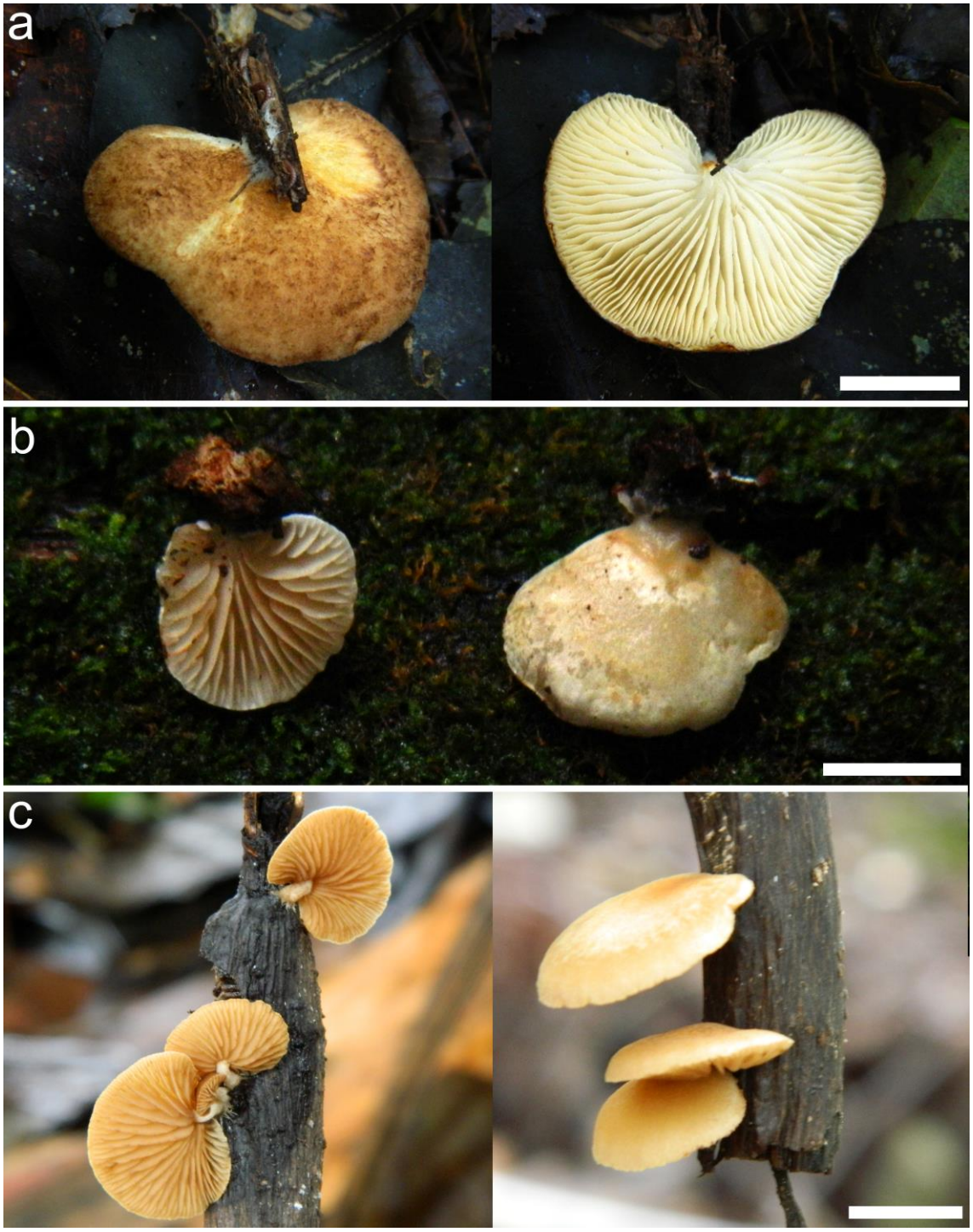

Figure 1 Basidiomata: a. *Crepidotus crocophyllus* (HCP 1155) b. *C. mexicanus* (HCP 1190) c. *Simocybe tucumana*. (HCP 1157). Scale bar = 10 mm.

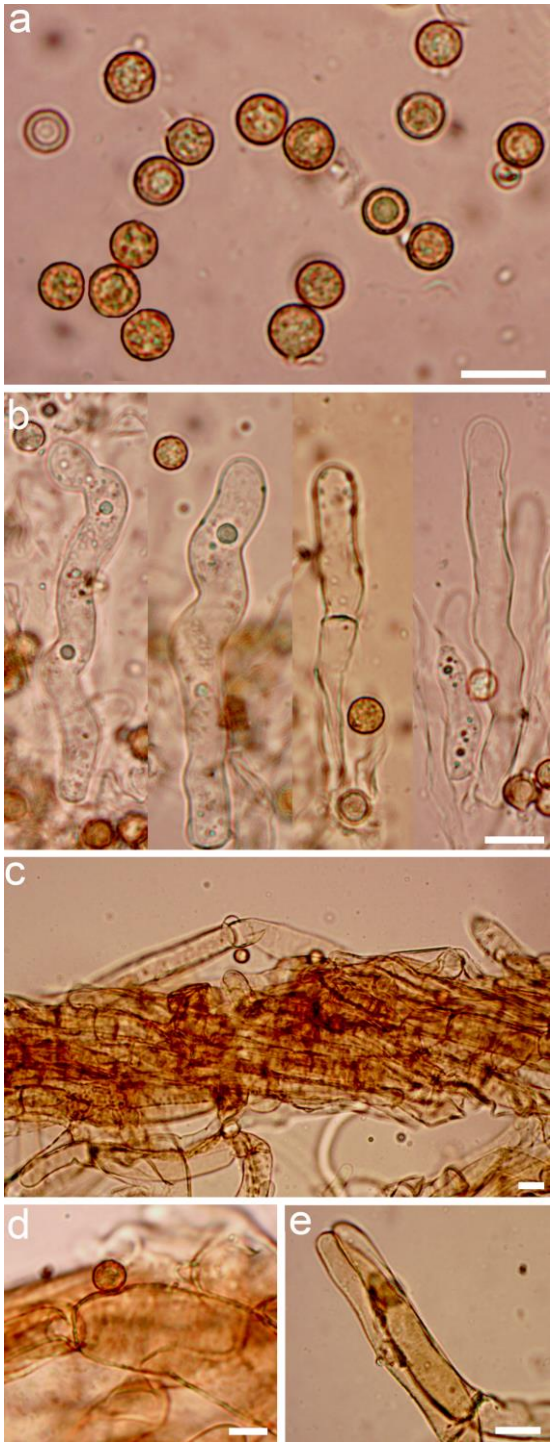

Figure 2 *Crepidotus crocophyllus* (HCP 1155): a. basidiospores b. cheilocystidia c. pilleipelis d. incrusted hyphae of pilleipellis e. terminal hyphae of pileipellis. Scale bar = 10 µm.

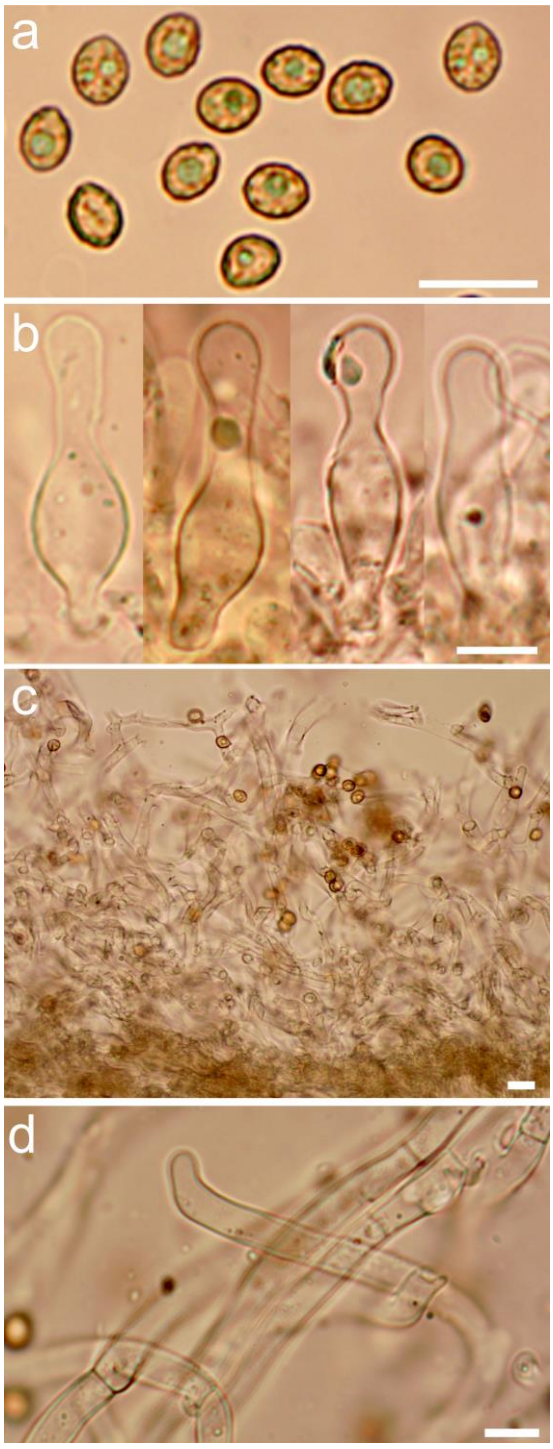

Figure 3 *Crepidotus mexicanus* (HCP 1190): a. basidiospores b. b. cheilocystidia c. pilleipelis d. terminal hyphae of pileipellis.

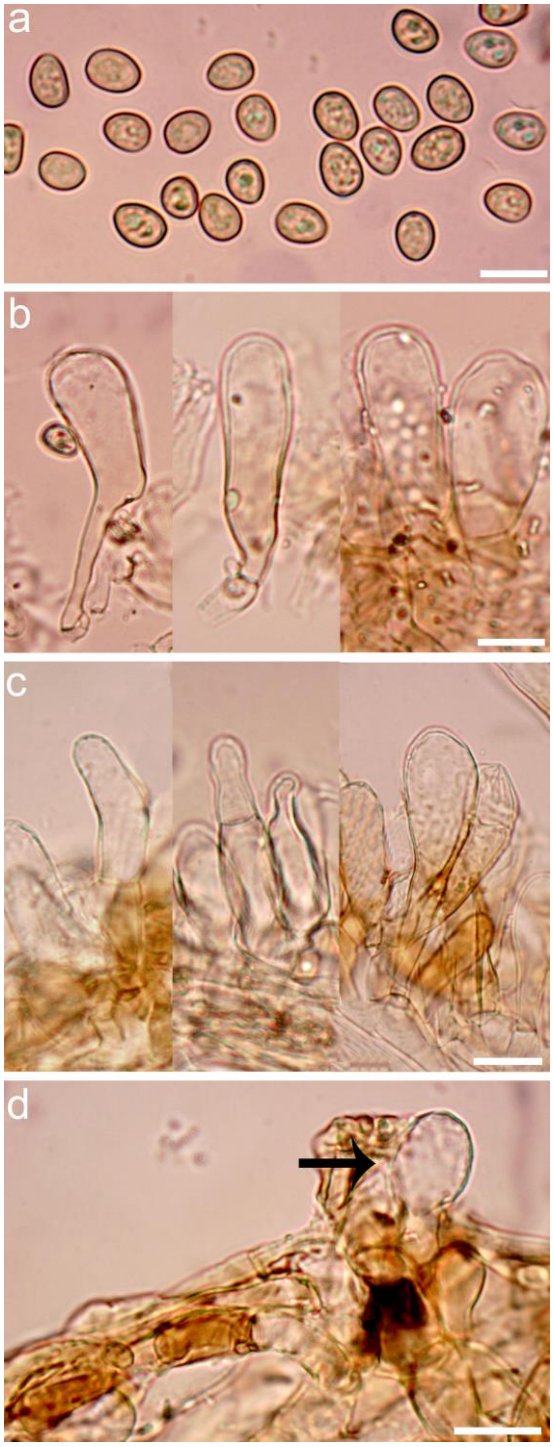

Figure 4 *Simocybe tucumana* (HCP 1159): a. basidiospores b. cheilocystidia c. caulocystidia d. pileipellis showing a pileocystidia. Scale bar = 10 µm.

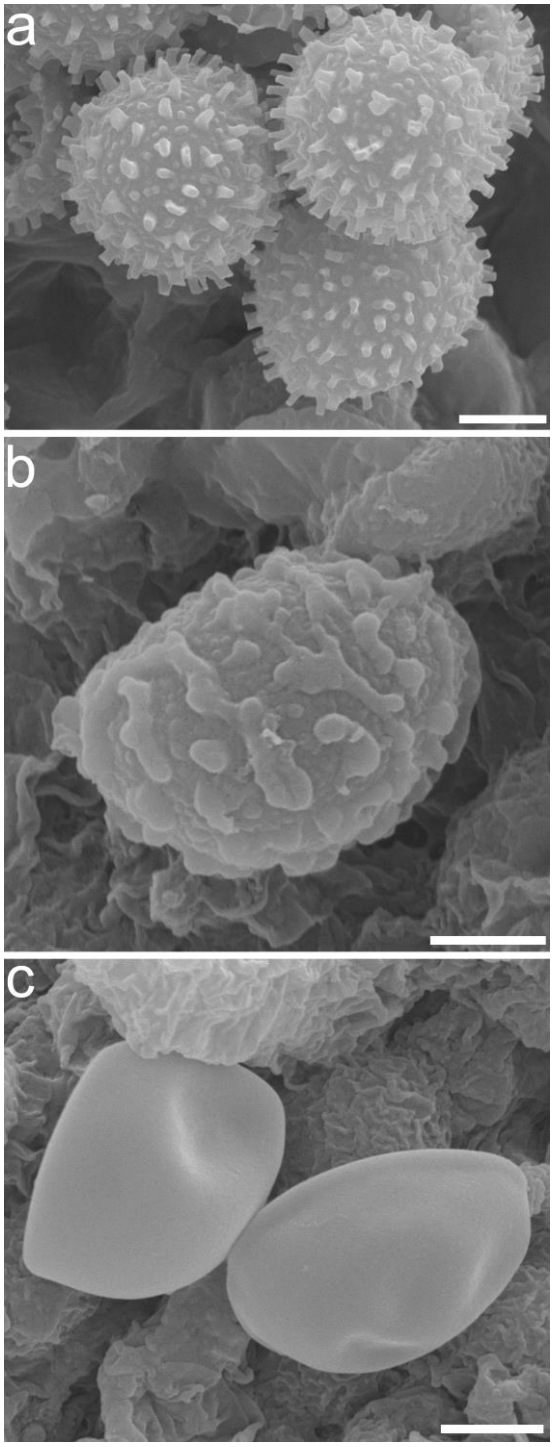

Figure 5 SEM of basidiospores: a. *Crepidotus crocophyllus* (HCP 1155) b. *C. mexicanus* (HCP 1190) c. *Simocybe tucumana*. (HCP 1158). Scale bar = 2 mm.

9 **Capitulo 6**: Artigo a ser submetido à Kew bulletin

PANAEOLUS (AGARICALES) FROM THE WESTERN PARANÁ STATE, SOUTH BRAZIL, WITH A DESCRIPTION OF A NEW SPECIES: *PANAEOLUS SILVATICUS*

Alexandre G. dos Santos Silva-Filho[1], Cristiane Seger[1] & Vagner G. Cortez[2]

Summary: Three species of *Panaeolus* were collected in the western region of Paraná State, South Brazil. *Panaeolus silvaticus* is proposed as a new species, based on macro- and micromorphological features and the substrate (rotten wood and litter); while *P. antillarum* and *P. papilionaceus,* two coprophilous and widely distributed species, are also reported. All species are illustrated and discussed in detail, regarding their taxonomy and distribution. A key with *Panaeolus* s.l. species reported in Paraná State is presented.

Key Words: mushrooms, *Psathyrellaceae*, Seasonal Semideciduous Forest, taxonomy

Introduction

Panaeolus (Fr.) Quél. is a small agaric genus, comprising about 12 – 15 species with worldwide distribution, since most members are associated to dung of several herbivores, especially cattle and horse (Gerhardt 1996). The genera *Copelandia* Bres. and *Panaeolina* Maire are considered distinct by some mycologists (Singer 1986; Young 1989), while others

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consider them into a broader concept of *Panaeolus* sensu lato (Ola'h 1969; Watling & Gregory 1987). Classified by Singer (1986) in the family Coprinaceae, recently it was suggested to belong in the Bolbitiaceae (Matheny *et al*. 2006), but in the Mycobank database, it is placed in the Psathyrellaceae. If the systematic position of the genus is unclear, the available data indicate that *Panaeolus* species may be placed in a new family with intermediate position between the Bolbitiaceae and Psathyrellaceae (Tóth *et al*. 2013).

In Brazil, 12 names were reported, mainly in South region of the country, however a few studies had focused on the genus and allies (Alves & Cavalcanti 1996; Stijve & Meijer 1993). Rick (1961) reported nine taxa of *Panaeolus* from Rio Grande do Sul State, but in most cases they are misidentifications, synonyms or lack specimens for revision. From the State of Paraná, Meijer (2006) listed the following species: *Panaeolus antillarum* (Fr.) Dennis, *P. cinctulus* (Bolton) Sacc., *P. foenisecii* (Fr.) J. Schröt, *P. papilionaceus* var. *parvisporus* Ew. Gerhardt and *P.* cf. *reticulatus* Overh. He also reported *P. cambodginiensis* Oláh & R.Heim, *P. cyanescens* (Berk. & Broome) Sacc., and *P.* aff. *tropicalis* Oláh, which are currently members of the neurotropic genus *Copelandia.*

Considering the limited knowledge of the mycodiversity, in particular of these fungi, we surveyed the agaricoid species from some areas in the western region of Paraná State. Our aim is to provide information on the richness, taxonomy and distribution of these mushrooms in that region. The results dealing with *Panaeolus* are presented in the present contribution as well we providence a key with species reported from Paraná State.

Materials and methods

Specimens were collected in two localities comprising fragments of Seasonal Semidecidual Forest (Atlantic Forest Biome) in the western region of Paraná State: RPPN Fazenda Açu, municipality of Terra Roxa, and São Camilo State Park, at the municipality of Palotina.

Morphological analysis (both macro- and microscopical) followed standard procedures for agaricoid fungi (Singer 1986). Colour names and codes used in the macroscopical descriptions are based on Kornerup & Wanscher (1978). In the basidiospores description, Q is the quotient between the length and width, Qm is the medium value of Q and n is the number of measured basidiospores/number of analyzed basidiomata/number of collections. Microscopic measurements and photographs were made under an Olympus CX31 optical microscope with a Toup Cam FMA050 digital camera, and measurements were taken through software Toup tek Toup View. All specimens were dried in open air drier (±38ºC) and are preserved at the mycological collection of the Herbarium of Federal University of Paraná (UPCB) and Herbarium of Campus Palotina (HCP).

Taxonomic treatment

Panaeolus antillarum *(Fr.) Dennis* (1961: 124). Epitypus: = *P. supulchalis* (*design. mihi*): Trinidad, *Dennis* 149 B, 23.nov. 1949.
≡ *Agaricus antillarum* Fr., Elench. fung. (Greifswald) 1: 42 (1828)

Pileus 29 – 39 mm diam., conic-campanulate becoming conic-convex to broadly-parabolic, surface smooth, cracking forming areolae at center, margin non striated, pale grey (1B1) with brownish orange (5C3) to orange grey (5B2) at the center. *Lamellae* adnate, crowded, with 3-sized lamelullae, edge serrate, discolor, paler with the sides, consistency fleshy, brownish grey (5D2, 5E2) with darker/clearer spots (mottled). *Stipe* 85 – 100 × 6 – 7 mm, central, cylindrical, equal to slightly bulbous at base, non fistulose, surface slightly striated and slightly velutinous near the apex, consistency fleshy, yellowish white (1A2) to pale grey

(1B1). *Context* thick (4-6 mm thick) fleshy, pale grey (1B1). *Veil* absent. *Spore print* dark grey (1F1).

Basidiospores 15.5 – 18 × 9.5 – 11 × 8.5 – 10.5 µm (Q=1.47 – 1.72, Qm=1.64, n=50/2/2), broadly ellipsoid to subhexagonal in face-view, elllipsoid in side-view, smooth thick-walled, apically truncate by a germ-pore, dark brow in KOH, not bleaching in 95 – 98% sulphur acid. *Basidia* 24 – 34.5 × 12.5 – 15 µm, broadly clavate to cylindro-clavate, tetrasporic hyaline in KOH. *Pleurocystidia* 26.5 – 41 × 12.5 – 19.5 µm, as chrysocystidia like-suphidia, non abudant, clavate, some with a small mucronate apex, fusoid, rarely pedicellate, thin-walled, hyaline with irregular golden yellow refractive body in KOH. *Cheilocystidia* 19.5 – 37 × 7 – 13 (– 17) µm, as leptocystidia, abundant, clavate, lageniform to fusoid, thin walled, hyaline in KOH. Lamella edge fertile. *Lamella trama* irregular, with filamentous to inflated hyphae 3.5 – 12 µm diam., smooth, hyaline in KOH. *Pileipellis* an epithelium of isodiametric to pyriform elements, 12.5 – 35.5 µm diam., smooth, hyaline in KOH. *Pileocystidia* 36.5 – 71 × 7 – 12.5 µm, scarce, forming fascicles at the pileus margin, cylindrical to lageniform, subcapitate, thin-walled, hyaline in KOH. *Pileus trama* with interwoven hyphae 4 – 14 µm diam., horizontally arranged, hyaline in KOH. *Stipitipellis* a cutis, composed of filamentous hyphae 1.5 – 6 µm diam., smooth, hyaline in KOH. *Stipite trama* regular, 4.5 – 12.5 µm diam., smooth, hyaline in KOH. *Caulocystidia* 18.5 – 39 × 3.5 – 12 µm, like cheilocystidia in shape. *Clamp connections* not observed. Fig. 1A, 2A–G.

DISTRIBUTION. Widely distributed in all continents (Halama *et al*. 2014). In Brazil, this mushroom has been reported from the South (Rio Grande do Sul, Santa Catarina and Paraná States), Southeast (São Paulo) and Midwest (Goiás State) regions (Maia *et al*. 2015). In Paraná State, it was recorded only in the East region, on Dense Ombrophilous Forest domain (Meijer 2006).

SPECIMEN EXAMINED: BRAZIL. Paraná State: Palotina, P.E. São Camilo, alt. 332 m, 24°18'15.83" S, 53°54'8.88" W., 18 Jun. 2016, *A. G. S. Silva-Filho* 793 (HCP 1168).

HABITAT: Gregarious to subcespitose, in dung cow on pasture,

CONSERVATION STATUS. Not evaluated.

NOTES. The robust and fleshy basidiomata with little pigment, initially viscid and not hygrophanous pileus, stipe with or without traces of a veil, smooth and opaque basidiospores with central germ-pore, presence of chrysocystidia-like sulphidia, are features that group *P. antillarum* in subgenus *Anellaria* (P. Karst.) Ew. Gerhardt. This subgenus also includes *Panaeolus semiovatus* (Sowerby) S. Lundell & Nannfeldt and its varieties, which differs from *P. antillarum* by the presence of a membranous veil. In addition, the basidiospores are longer in *P. semiovatus* (up to 24 um long), when compared with *P. antillarum* (up to 20 µm long – Gerhardt 1996). Furthermore, *P. antillarum* is well distributed in both tropical and subtropical zones, while *P. semiovatus* prefers temperate regions (Halama *et al.* 2014). This mushroom is frequently found in pastures, mostly on cow dung, as one of the commonest coprophilous agarics in South Brazil.

Panaeolus antillarum is a mushroom species frequently misidentified by people looking for as a recreational/psychedelic fungi, since it is very similar to *Copelandia cyanescens* (Berk. & Broome) Singer, a potentially psychoactive species (Stamets 1996). The latter species is also a common coprophilous mushroom found in the same habitats in western of Paraná State (Silva-Filho *et al*. 2017 in process) and, in spite of macroscopically similar, basidiomata of *C. cyanescens* are smaller and becomes bluish when touched. The absence of psilocybin, psilocin and baeocystin, as well the presence of serotonin and 5-OH-tryptophan, was reported by Stijve & Meijer (1993), based in Paraná specimens; Halama *et al.* (2014), found similar results in Polish materials.

Panaeolus papilionaceus *(Bull.) Quél.*, (Quélet 1872: 152). Lectotypus: = *Agaricus papilionaceus* (*design. mihi*): Bulliard, Herb France, Tf. 58 1781

= *Agaricus campanulatus* Fr., Syst. mycol. (Lundae) 1: 295 (1821)

Pileus 12 – 31 mm diam., conico-campanulate to convex, sometimes umbonate, surface smooth, cracking at center, margin non striated, brownish grey (5C2) to light brown (5D4) at the disc, hygrophanous. *Lamellae* adnate, crowded, with 2- sized lamelullae, edge even, concolor with the sides, consistency fleshy, greyish grey (1D2) to medium grey (5E1), mottled. *Stipe* 33 – 110 × 2 – 5 mm, central, cylindrical, equal to slightly bulbous at base, fistulose, surface smooth, consistency fleshy, yellowish white (1A2), pale grey (1B1) at apex, light brown (6D4) at center, and light brown (6D5, 7D5) toward the base. *Context* thin (1.5 – 3 mm thick) fleshy, pale grey (1B1). *Veil* present at pileus margin, producing appendiculate to dentate sub-membranous remnants in young specimens. *Spore print* dark grey (1F1). *Basidiospores* 11.5 – 14.5 × 7.5 – 9 × 6 – 7.5 µm (Q= 1.36 – 1.68, Qm= 1.49, n= 30/1/3), limoniform in face-view, elliptic in lateral-view, smooth, thick-walled, apically truncate by a germ-pore, dark brown in KOH, not bleaching in 95 – 98% sulphuric acid. *Basidia* 20.5 – 25 × 9.5 – 13.5 µm, broadly clavate to cylindro-clavate, tetrasporic, hyaline in KOH. *Pleurocystidia* absent. *Cheilocystidia* 20.5 – 33.5 × 4 – 7.5 µm, as leptocystidia, abundant, cylindrical, versiform, ventricose, thin walled, hyaline in KOH. Lamella edge sterile. *Lamella trama* regular, with filamentous and inflated hyphae 3.5 – 8 µm diam., smooth, hyaline in KOH. *Pileipellis* an epithelium of isodiametric to pyriform elements, 10.5 – 19 µm diam., smooth, hyaline and some with light brownish content in KOH. *Pileocystidia* 19.5 – 44 × 7 – 12.5 µm, scattered, and in fascicles at the pileus margin, cylindrical to lageniform, with subcapitate apex, thin-walled, hyaline in KOH. *Pileus trama* with interwoven and inflated hyphae, 10.5 – 20.5 µm diam., hyaline in KOH. *Stipitipellis* a cutis, composed of filamentous

hyphae 1.5 – 4.5 µm diam., smooth, hyaline in KOH. *Stipite trama* regular, 3.5 – 16.5 µm diam., smooth, hyaline in KOH. *Caulocystidia* 18.5 – 56 × 5.5 – 10.5 µm, clavate, some with swollen apex, flexuous, thin walled, hyaline in KOH. *Clamp-connections* present. Fig. 1B,C, 2A–E.

DISTRIBUTION. Cosmopolitan (Guzmán *et al.* 2000). In Brazil, reported from South (Rio Grande do Sul, Paraná) and Southeast (São Paulo) regions (Maia et al. 2015). In Paraná, this mushroom is known only in eastern region of the State on Dense Ombrophilous Forest domain (Meijer 2006).

SPECIMEN EXAMINED: BRAZIL. Paraná State: Palotina, P.E. São Camilo, alt. 332 m, 24°18'15.83" S, 53°54'8.88" W., 18 Jun. 2016, *A. G. S. Silva-Filho* 798 (HCP 1167) and 799 (HCP 1166); 23 Jun. 2016, *A. G. S. Silva-Filho* 801 (HCP 1152) and 803 (HCP 1170).

HABITAT: Solitary on cow dung, in pastures.

CONSERVATION STATUS. Not evaluated.

NOTES. The absence of metuloidal cystidia, limoniform basidiospores in face-view, the cap with trace of visible dentate or appendiculate veil in the margin and non-bluing basidiomata, places *P. papilionaceus* in subgenus *Panaeolus*, section *Panaeolus sensu* Gerhardt (1996). Our collection agrees well with the description of Gerhardt (1996) from Germany, although basidiospores were slightly smaller when compared to other described materials from Europe (Watling & Gregory 1987) and North America (Desjardin *et al*. 2015). Gerhardt (1996) considered specimens with smaller basidiospores (13 – 15 × 8 – 10 × 6 – 8 µm) and very fugacious veil in *P. papilionaceus* var. *parvisporus* Ew. Gerhardt. Our specimens presenting smaller basidiospores (up to 14.5 µm long) and a fugacious veil is observed in young basidiomata, thus, we preferred to consider south Brazilian specimens in the broadest concept of the species.

Panaeolus venezolanus Guzmán, from Venezuela and Mexico, is similar in some aspects to *P. papilionaceus*, however it is an annulate species (Guzmán 1978; Gerhardt 1996). *Panaeolus rubricaulis* Petch, from Siri Lanka, is another similar species to, but differs in the presence of cheilocystidia with sulphidia content (Gerhardt 1996).

According to Guzmán *et al*. (2000), *P. papilionaceus* var. *papilionaceus* is the only with hallucinogenic status, but the same is not reported in the litearature for the var. *parvisporus.*

Panaeolus silvaticus *Silva-Filho, C. Seger & Cortez*, **sp. nov.** Type: Brazil. Paraná State: *Silva-Filho* 478 (UPCB – holotype here designated).

MycoBank: Nº xxxx

Pileus 5 – 14 mm diam., broadly plane umbonate, convex, conico-campanulate to broadly parabolic, surface smooth to slightly fibrillose, margin striated, rarely non striated, occasionally undulating, color varying from pale grey (1B1), light grey (1C1), grey (1D1), greyish yellow (1B4), yellowish grey (2B2), greenish grey (1B2) to olive (2E3, 1F8) and olive brown (4F8). *Lamellae* adnate, crowded, with 2- sized lamelullae, edge even to slightly crenate, some with inconspicuous off-white droplets secretion, consistency subfleshy, olive grey (1F8, 2F2), becoming dark grey (1F7) mottled. *Stipe* 33 – 52 × 1.5 – 3 mm, central, cylindrical, equal, fistulose, with an insidious base, but occasionally with a white (1A1) mycelial pad, surface striated to slightly pubescent, consistency fleshy to coriaceous, yellowish white (1B1), greyish orange (5B4), light orange (6A4) at apex, yellowish brown (5F8) brown (6E5, 6E4, 7E3) dark brown (6F8) toward the base. *Context* thin (1 – 2 mm thick) fleshy, pale grey (1B1) to yellowish brey (1A2). *Veil* absent. *Spore print* dark grey (1F1).

Basidiospores 8.5 – 11.5 (– 12.5) × 6 – 8 (– 8.5) × 4.5 – 6.5 µm (Q= 1.31 – 1.83, Qm= 1.47, n=50/3/3), ellipsoid to limoniform in face-view, ellipsoid in lateral-view, smooth, thick-

walled, apically truncate by a germ-pore, brown to dark brown in KOH, not bleaching in 95 – 98% sulphuric acid. *Basidia* 17 – 21 (– 28) × 7 – 10 µm, broadly clavate to cylindro-clavate, bi-and tetrasporic, hyaline in KOH. *Pleurocystidia* absent. *Cheilocystidia* 26 – 40 × 4.5 – 10 µm, as leptocystidia, abundant, clavate, clavate-pedicellate, cylindrical, cylindro-clavate, flexuous, rarely ventricose, some septate, thin-walled, hyaline in KOH, with yellowish oil content. Lamella edge fertile. *Lamella trama* slightly interwoven, with filamentous and inflated hyphae 2.5 – 15 µm diam., smooth, hyaline and yellowish brown in KOH. *Subhymenium* with filamentous hyphae, 2 – 4.5 µm diam., smooth, light brown in KOH. *Pileipellis* an epithelium, composed of cylindrical, isodiametrical to pyriform elements, 11 – 33 µm diam., smooth, hyaline in KOH. *Subpellis* a layer of filamentous hyphae, 2.5 – 4 µm diam., parallel, horizontally arranged, smooth, light brown in KOH. *Pileocystidia* 19.5 – 44 × 7 – 12.5 µm, scattered at pileus center and in fascicles in the pileus margin, cylindrical, clavate, lageniform, thin-walled, hyaline in KOH, with yellowish oil content, more evident at margin. *Pileus trama* with interwoven, filamentous and inflated hyphae 4.5 – 16.5 µm diam., horizontally arranged, hyaline and yellowish brown in KOH. *Stipitipellis* a cutis, composed of filamentous hyphae 1.5 – 3.5 µm diam., smooth, light brown in KOH. *Stipite trama* regular, 5 – 12 µm diam., smooth, hyaline and light brown in KOH. *Caulocystidia* 27 – 54 (– 57) × 3 – 11.5 µm, clavate, some with swollen apex, flexuous thin walled hyaline in KOH, with yellowish oil content at apex. *Clamp-connections* not conspicuous, observed only at the base of basidia and cystidia. *Oleipherous* hyphae observed in subpellis layer of pileipellis, lamella and stipe trama. Fig. 1D–F, 4A–G.

RECOGNITION. Basidiomata solitary, growing on very rotten wood, fallen leaves and small branches, non-coprophilous. Pileus up to 15 mm diam., lamellae adnate, with inconspicuous paler droplets secretion, stipe central, cylindrical, equal, fistulose. Basidiospores 8.5 – 11.5 × 6 – 8 × 4.5 – 6.5 µm ellipsoid to limoniform in face-view, ellipsoid

in lateral-view, smooth, thick-walled, apically truncate by a germ-pore, brown to dark brown in KOH. Pleurocystidia absent, cheilo, pileo and caulocystidia with yellowish oil content. Inconspicuous clamp-connections.

DISTRIBUTION. Know only from type locality.

SPECIMEN EXAMINED. BRAZIL. Paraná State: Palotina, P.E. São Camilo, alt. 332 m, 24°18'24.98" S, 53°54'22.24" W, 27 Apr. 2015, *A. G. S. Silva-Filho* 322 (HCP 1214); 09 Jun. 2015, *A. G. S. Silva-Filho* 478 (UPCB); 30 Oct. 2015, *A. G. S. Silva-Filho* 636 (HCP 1215). Terra Roxa, RPPN Fazenda Açu, alt. 332 m, 24°11'51.66" S, 53°58'36.51"W, 01 Jun. 2015, *A. G. S. Silva-Filho 444* (HCP 1216); 20 Jul. 2015, *A. G. S. Silva-Filho* 549 (HCP 1217); 12 Nov. 2016, *A. G. S. Silva-Filho* 650 (HCP 1218); 13 Dec. 2016, *A. G. S. Silva-Filho* 780 (HCP 1219).

HABITAT. Solitary, growing on very rotten wood, fallen leaves and small branches, in the seasonal semideciduous forest.

CONSERVATION STATUS. Not evaluated.

ETYMOLOGY. From Latin *Silva* = Forest. Referring to the habitat of collection.

NOTES. *Panaeolus silvaticus* is diagnosed by a small pileus (<14 mm), grey to olive colored, smooth to slightly fibrillose surface, margin of lamellae with off-white droplets secretion, basidiospores ellipsoid to limoniform in face-view, absence of pleurocystidia, cystidia (cheilo-, pileo- and caulocystidia) with yellowish oil content and presence of clamp-connections.

By virtue of the smooth basidiospores, absence of a membranous annulus, absence of metuloids and chrysocystidia, as well as the gill edge bearing cheilocystidia secreting yellowish droplets, *Panaeolus silvaticus* belongs in *Panaeolus* subgen. *Panaeolus* sect. *Guttulati* Ew. Gerhardt; this is a monotypic section, comprising only *P. guttulatus* Bres., a

species known recorded from Europe and South Africa (Gerhardt 1996). *Panaeolus guttulatus* and *P. silvaticus* share some morphological similarities: both present gray to olive color in the pileus, pileocystidia and cheilocystidia with yellowish pigmentation, basidia bi-and tetrasporic, and absence of pleurocystidia (Gerhardt 1996). However, *P. guttulatus* has a much darker colored and more robust pileus (10 – 30 mm diam.), shorter and narrower basidiospores (7 – 9 × 4 – 5 µm) with oil droplets and narrower cheilocystidia (3.9 – 4.3 µm - Pancorbo & Ribes 2010). The production of a viscous substance by the cheilocystidia is a remarkable feature in *P. guttulatus* and can be observed even in dried specimens (Gerhardt 1996), while in *P. silvaticus* it is not so conspicuous. In addition, *P. silvaticus* grows on rotting wood and leaf litter in Atlantic Forest, in contrast to *P. guttulatus*, which is gathered on sandy soil in temperate areas of Europe and South Africa (Gerhardt 1996; Pancorbo & Ribes 2010).

Panaeolus fraxinophilus A.H. Sm., from North America, is another non-coprophilous species without pleurocystidia, similar pileus size 8 – 15 mm, and basidiospores measuring 9 – 11 × 6.5 – 7 × 5 – 6 µm (Smith 1948). In spite of these similarities, *P. fraxinophilus* has dark gray to sordid yellowish brown color in the pileus, not producing yellowish content in the cystidia, and the cheilocystidia are narrower (4 – 5 µm diam. - Smith 1948). Moreover, *P. fraxinophilus* is a lignicolous species and grows on a specific host, trunks of *Fraxinus* spp. (Smith 1948).

Finally, *P. lignicola* Rick, from Rio Grande do Sul State, South Brazil, is also a non-coprophilous species with similar size in basidiomata, the pileus 8 mm diam., stipe 20 × 2mm, basidiospores are 10 – 12 × 8 – 9 µm (Rick 1961). Gerhardt (1996) revised a probable neotype preserved at Herbarium PACA, and reported larger spores (12 – 14 × 8.5 – 9 × 7 – 7.5 µm). In conclusion, Gerhardt (1996) considered Rick' specimen as a member of *Psilocybe* (Fr.) P. Kumm., possibly *Ps. coprophila* (Bull.) P. Kumm, especially based on the

examination of the basidiospores under KOH. It is not reported, neither by Rick or by Gerhardt, the presence of any kind of cystidia neither the presence of droplets in the gill margin, which are diagnostic for a more conclusive identification. The holotype from São Leopoldo probably was not preserved, as usual for several Rick's new taxa; the above cited material that is preserved at the Herbarium PACA is from Santa Maria and was designated as neotype by Gerhardt (1996). Given the differences in basidiospore size and color, as mentioned by Rick (pale violaceous) and Gerhardt (light yellow, under KOH), it is very probable that the preserved neotype does not correspond to original description by Rick, and thus *P. lignicola* may be considered a doubtful name.

Based on the above discussion and considering the distinctive morphological features and substrate and habitat preferences, we propose *P. silvaticus* as a new species in the genus.

Key of *Panaeollus* s.l. species from Paraná State

1. Spore print dark-brow, basidiospores distinctly roungh.....

……..….***Panaeolina foenisecii*** (Stive & Meijer 1993 as *Paneolus foenisecii*)

1. Spore print black, basidiospores smooth…….....2

2. Metuloidal cystidia present …..…….……..……...3

2. Cystidia thin walled, chrysocystidia like sulphidia often present….……...……...6

3. Basidiospores up to 9 µm long, found on decomposed wood or litter in forest …..……

…….....…….....……***Copelandia mexicana*** (Silva-Filho *et al.* 2017 in process)

3. Basidiospores > 9 µm long, found on soil and manured…….....4

4. Basidiospores about 8–12 µm long…….5

4. Basidiospores about 11.5–14.5 µm long …….……-

-…….. ***Copelandia cyanescens*** (Silva-Filho *et al.* 2017 in process)

5. Metuloidal cystidia very tick-walled, dark reddish-brown colored …….....

.....***Copelandia tropicalis*** (Meijer 2006, as *Panaeolu*s aff. *tropicalis*)

5. Metuloidal cystidia generally thin-walled, very pallid…….……

……....…….***Copelandia cambodginiensis*** (Meijer 2006 as *Panaeolus cambodginiensis*)

6. Pleurocystidia absent……..……7

6. Pleurocystidia present as chrysocystidia like sulphidia ……..…..***Panaeolus antillarum***

7. Cheilocystidia with yellowish oil content, fond in forest……....***Panaeolus silvaticus***

7. Cheilocystidia without yellowish oil content, found in pastures and swamps**.....**……..8

8. Basidiospores about 8–11 µm long……...……

……. ***Panaeolus reticulatus*** (Meijer 2006 as *Panaeolus* cf. *reticulatus*)

8. Basidiomata without remaining veil, cheilocystidia often capitate < 35 µm long…….....

……..... ***Panaeolus cinctulus*** (Meijer 2006)

9. Basidiomata with remaining veil, cheilocystidia cylindrical 20.5 – 33.5 µm long……

……..….**.....**…***Panaeolus papilionaceus***

Acknowledgements

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Figure 1: Basidiomata of *Panaeolus*. A *P. antillarum*, B *P. papilionaceus*, young specimens with appendiculate veil (arrow), C *P. papilionaceus* D-G *P. silvaticus.* Scale bar: 10 mm.

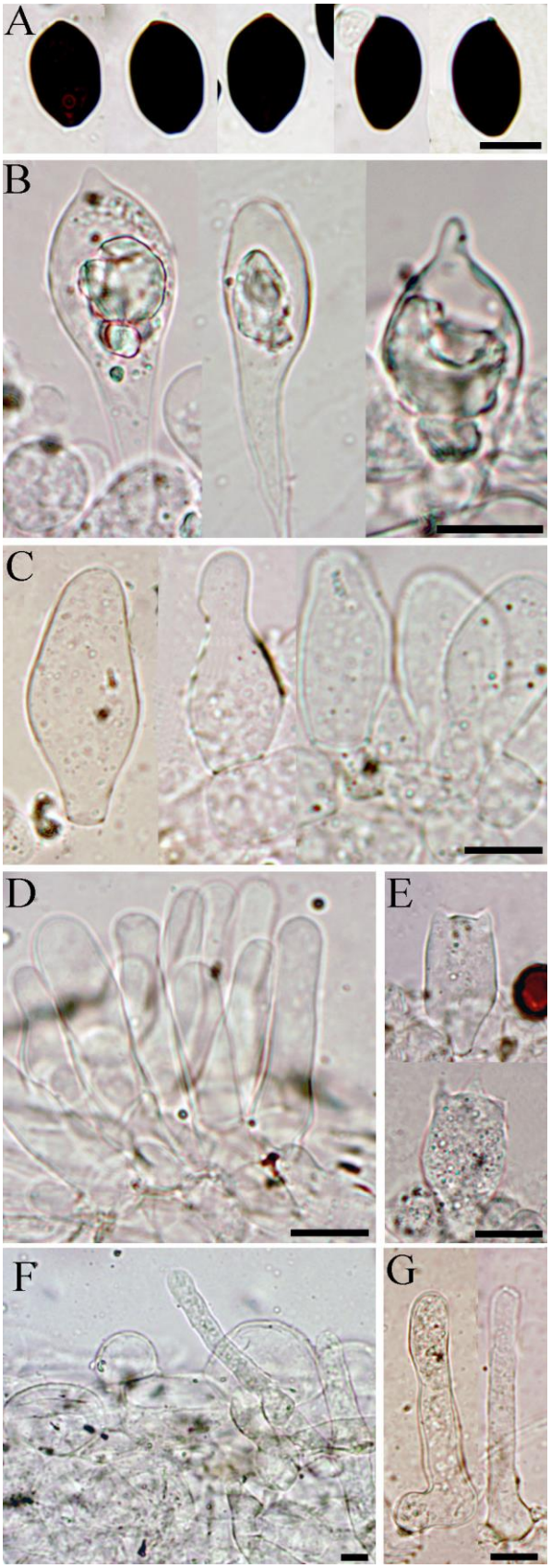

Figure 2: *Panaeolus antillarum*. A Basidiospores, B Pleurocystidia, C Cheilocystidia, D Caulocystidia, E Basidia, F Pileipellis, G Pileocystidia. Scale bar = 10 µm.

Figure 3: *Panaeolus papilionaceus*. A Basidiospores, B Basidia, C Cheilocystidia, D Caulocystidia, E, Pileipellis with pileocystidia (arrow). Scale bar = 10 µm.

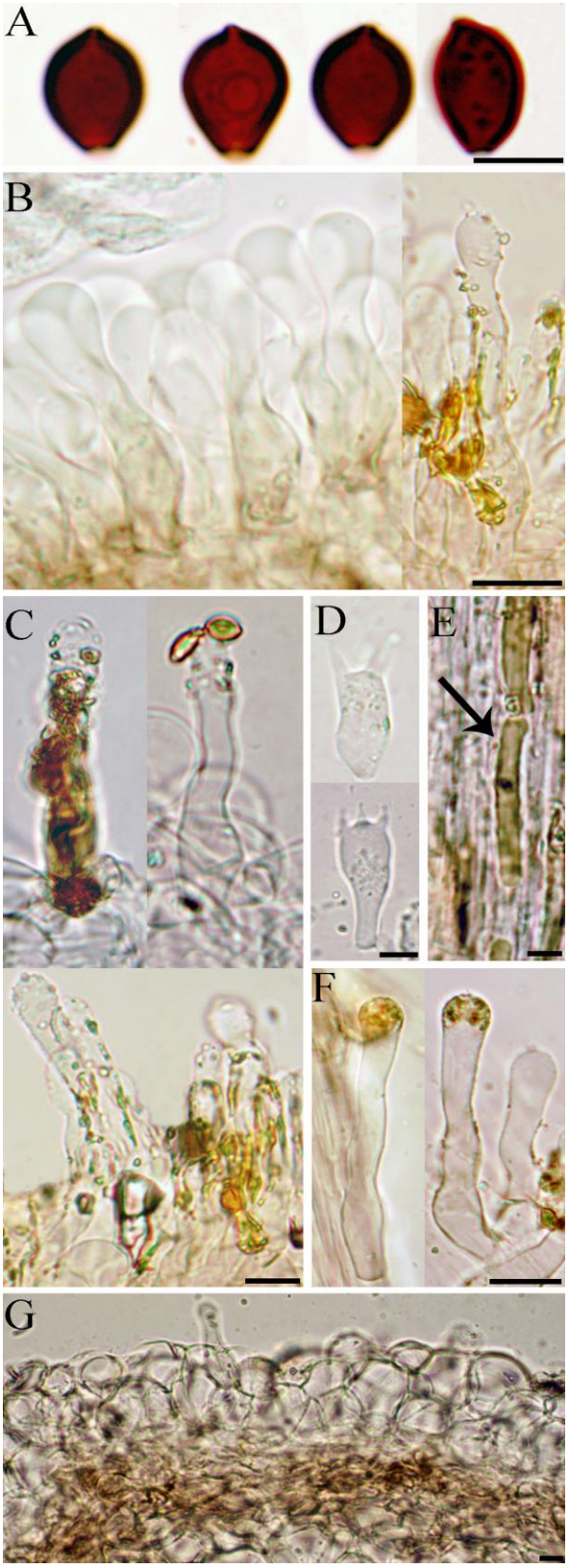

Figure 4: *Panaeolus silvaticus.* A Basidiospores, B Cheilocystidia, C Pileocystidia, D Basidia, E, Stipite trama with oleipherous hyphae (arrow), F Caulocystidia, G Section of pileus showing the pileipellis with pileocystidia. Scale bar = 10 µm.

10 Capitulo 7: Artigo a ser submetido à Mycotaxon

Annotated checklist of *Agaricales* (*Basidiomycota*) from Seasonal Semidecidual Forests of Paraná State, Brazil

MYCOTAXON 2016 style guide

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ABSTRACT: A list of the *Agaricales* from Seasonal Semidecidual Forests of western Paraná State, South Brazil, is presented. This survey is based on field expeditions in three fragments of this ecosystem, and revision of herbarium specimens. Have been identified 104 taxa in these area, which represent 57 genera and 17 families. Among these, four species are new records from Brazil, six are new from Paraná State and 21 taxa are new register from Seasonal Semidecidual Forest. Species supposedly new are discussed briefly and comprise 32 taxa.

KEYWORDS: Atlantic Rain Forest, agaricoid fungi, distribution, mycodiversity

Introduction

Agaricales Underw., are a large lineage of mushroom forming fungi, whose hymenophore can be formed by lamellae, tubes, pores, smooth or even enclosed, thus producing a wide variety of morphological types, including the common agaricoid, as well the poroid, pleurotoid, gasteroid, secotioid, cyphelloid, corticioid, coralloid, and hydnoid habits (Hibbett et al. 2014). Members of *Agaricales* are composed of a monomitic hyphal system and produces a high variety of basidiospores, cistydia, pileipellis and other microstructures (Largent et al. 1977, Pegler 1983, Singer 1986).

Fungi belonging to this order are abundantly found in Neotropical zone, including the Atlantic Rain Forest, one of the largest and most important South American biomes (Maia et al. 2015). Among the numerous vegetation typologies in this biome, the Seasonal Semidecidual Forest ecosytem is

characterized by the presence of a few deciduous trees, which loose completely their leaves in the, winter, the dry season (Kozera & Peluci 2015). In this forest type, the dominant trees are mainly members belonging to the *Anacardiaceae*, *Apocynaceae*, *Bignoniaceae*, *Boraginaceae*, *Caricaceae*, *Fabaceae*, *Malvaceae*, *Meliaceae*, *Moraceae*, *Rutaceae* and *Sapindaceae* (Roderjan et al. 2002).

In spite of a recent survey reporting 926 spp. of *Agaricales* in Brazil and 517 spp. from the Atlantic Forest (Maia et al. 2015), the knowledge on the mycobiota of Seasonal Semideciduous Forests of south Brazil remains limited. In Paraná State, where about nine hundred agarics have been reported, the fieldwork has been focused on the Dense and Mixed Ombrophilous Forests (de Meijer 2001, 2006, 2008, 2010).

Since 2010 we have surveyed the diversity of the macrofungi from the western Paraná State, resulting in some contributions which describe new species and records of *Agaricales* from that region (Ferreira & Cortez 2012, Ferreira et al. 2013, Alves & Cortez 2013a, 2013b, Dias & Cortez 2013 Alves & Cortez 2014).

In this paper we present a checklist of the *Agaricales* from Seasonal Semidecidual Forest, western Paraná State, collected in 2015, with additional specimens collected since 2010, in order to provide a preliminary account on the knowledge of the macrofungi from that ecosystem.

Materials & Methods

Fieldwork was conducted from January to December 2015, in two remanescents of Seasonal Semidecidual Forest from the western region of Paraná State: a) São Camilo State Park (abbreviated as PESC), placed in the municipality of Palotina (24°18'47.41" S and 53°54'47.11" W) and b) Private Reserve of Natural Heritage Fazenda Açu (abbreviated as RPPN Fazenda Açu, situed in the municipality of Terra Roxa 24°11'28.05" S and 53°58'6.92" W). Specimens collected from 2010 to 2014, in the two locations already mentioned and the c) Campus of Universidade Federal do Paraná (abbreviated as UFPR) at Palotina (24°17'34.43" S and 53°50'31.85" W) also placed in the municipality of Palotina and preserved in the herbarium of Universidade Federal do Paraná, Campus Palotina (HCP) were also

considered in the present survey. All collected specimens are preserved in this same herbarium; types and additional materials are indicated, when available. Whenever necessary scanning electron micrographs (SEM) were performed in species with ornamented basidiospores at the Center of Electron Microscopy of the Federal University of Paraná at Curitiba (CME/UFPR), under a Jeol JSM-6360LV scanning electron microscope.

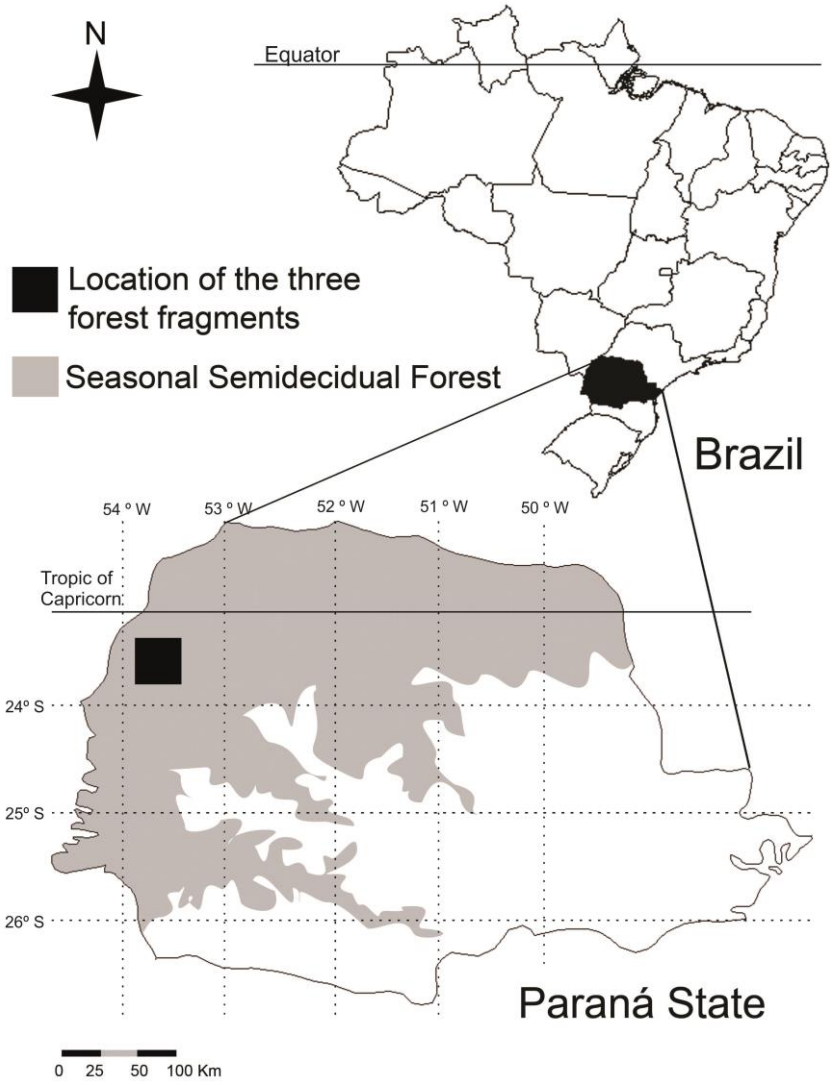

Figure 1: Location of study area in western Paraná state, Brazil.

Annoted checklist of *Agaricales* from Seasonal Semidecidual forest, western Paraná State, Brazil

× First record from Seasonal Semidecidual Forest of Paraná State
✓ First record from Paraná State
☑ First record from Brazil

Agaricaceae Chevall.

Agaricus endoxanthus Berk. & Broome ✓ Plate 1A

EXAMINED SPECIMENS: RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, on soil, 06 Apr. 2015, leg. AGS Silva-Filho 249 (HCP 1094).
LITERATURE: Pegler (1983).
Notes: It's a tropical species originally described from Sri Lanka (Berkeley & Broome 1871). *Agaricus endoxanthus* is diagnosed by the: context of stipe base instantly chrome yellow on exposure, pileus size with pale grey color, minutely squamulose, stipe cylindrical with subbubous base, basidiospores ellipsoid and cheilocystidia piriform. In Brazil was recorded only in São Paulo State, (Pegler 1997). It is a new record from Paraná State.

Agaricus ochraceosquamulosus Heinem. ☑ Plate 1B
EXAMINED SPECIMENS: RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, on soil, 14 Oct. 2015, leg. Silva-Filho 620 (HCP 1104).
LITERATURE: Pegler (1983).
Notes: *Agaricus ochraceosquamulosus* was described from Trinidad by Heinemann (1961), who considered the species diagnosed by the following features: Pileus fleshy, ochraceous-cream with minute rufous and ochraceous innate squamules, stem cylindrical, annulus ochraceous cream to white, membranaceous, narrow and fragile and basidiospores ellipsoid. It is known from Caribean Antilles (Heinemann 1961, Pegler 1983) China (Zhishu et al. 1993), and now its distribution is extended to Brazil.

Agaricus purpurellus F.H. Møller × Plate 2C–D
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 11 Feb 2015, leg. AGS Silva-Filho 127 (HCP 1102); *ibid*, 13 May 2015, AGS Silva-Filho 258 (HCP 1100); *ibid*, 27 July 2015 AGS Silva-Filho 575 (HCP 1101). RPPN Fazenda açu, 24°11'28.05" S and 53°58'6.92" W, 24 Feb. 2015, AGS Silva-Filho 154 (HCP 1098), *ibid*, 06 Apr. 2015, AGS Silva-Filho 234 (HCP 1099).
LITERATURE: de Meijer (2008).
Notes: Pegler (1997) report this species from São Paulo State, latter de Meijer (2008) from Mixed Ombrophilous Forest of eastern Paraná State.

Agaricus volvatulus Heinem. & Gooss.-Font. × Plate 1E
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 02 Mar. 2015, leg. AGS Silva-Filho 177 (HCP 1095); *ibid*, 09 June 2015, AGS Silva-Filho 468 (HCP 1097). RPPN Fazenda açu, 24°11'28.05" S and 53°58'6.92" W, 04 Dec. 2015, AGS Silva- Filho 704 (HCP 1096).
LITERATURE: Chen et al. (2016).
Notes: This is a tropical species (Chen et al. 2016) recorded in Brazil only by de Meijer (2006) from Mixed Ombrophilous Forest in eastern region of Paraná State.

Arachnion album Schwein.
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 27 Jan. 2011, A.J. Ferreira & V.G. Cortez 17-33 (HCP 207); *ibid*, 23 Apr. 2012 C.R. Alves & V.G. Cortez 56 (HCP 206).
LITERATURE: Alves & Cortez (2014)

Bovista aestivalis (Bonord.) Demoulin
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 03 Mar. 2011, V.G. Cortez 17-31 (HCP 208).
LITERATURE: Alves & Cortez (2014)

Bovista dominicensis (Massee) Kreisel
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil and decomposing wood, 16 Feb. 2011, leg. V.G. Cortez 18-39 (HCP 210); *ibid*, 23 Nov. 2011, leg. C.R. Alves 10 (HCP 211); *ibid*, 13 Feb. 2012, C.R. Alves 13 (HCP 209); *ibid*, 19 Jan. 2015, leg. AGS Silva-Filho 112. UFPR, 24°17'34.43" S and 53°50'31.85" W, 29 Feb. 2012, C.R. Alves 86 (HCP 393).
LITERATURE: Alves & Cortez (2014)

Calvatia cyathiformis (Bosc) Morgan
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 31 Jan. 2012, leg. C. Kozera 4242 (HCP 214).
LITERATURE: Alves & Cortez (2014)

Calvatia fragilis (Vittad.) Morgan
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 16 Feb. 2011 leg. V.G. Cortez 18-33 (HCP 217). UFPR, 24°17'34.43" S and

53°50'31.85" W, 12 Sep. 2011, leg. C.R. Alves 04 (HCP 392); *ibid*, 23 Nov. 2011, C.R. Alves 89 (HCP 398); *ibid*, V.G. Cortez 013/10; *ibid*, 29 Feb. 2012, leg. V.G. Cortez & C.R. Alves 20 (HCP 215).
LITERATURE: Alves & Cortez (2014)

Calvatia guzmanii C.R. Alves & Cortez
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on litter and ocassionally on decomposing wood, 10 Dez. 2010, leg. V.G. Cortez 15-39 (HCP 218); *ibid*, 16 Feb. 2011, V.G. Cortez 18-43 (UPCB 73369, Holotype), *ibid*, 18 Feb. 2011, V.G. Cortez 18-30 (HCP 219); *ibid*, 02 Mar. 2012, V.G. Cortez 19-31 (HCP 222) and 19-32 (HCP 223); 03 June 2012, leg. C.R. Alves 22 (HCP 224) and 23 (HCP 225); 17 Apr. 2012 C.R. Alves 25 (HCP 226); *ibid*, 18 June 2012, leg. V.G. Cortez & C.R. Alves 38 (HCP 227) and 44 (HCP 228); *ibid*, 27 Apr. 2015, leg. AGS Silva-Filho 308 (HCP 1066) and 336 (HCP 1064).
LITERATURE: Alves & Cortez (2013b)

Calvatia rugosa (Berk. & M.A. Curtis) D.A. Reid
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 02 June 2010, leg. A.J. Ferreira & D. Souza 3-16 (HCP 232); *ibid*, 03 May 2012, leg. C. Kozera 4178 (HCP 234) and 4180 (HCP 236); *ibid*, 15 May 2012, leg. V.G. Cortez 007/12 (HCP 238), 008/12 (HCP 239) and 009/12 (HCP 236); *ibid*, 18 May 2015, leg. AGS Silva-Filho 417 (HCP 1057). UFPR, 24°17'34.43" S and 53°50'31.85" W, 29 Februari 2012 leg. C. R. Alves 94 (HCP 413); *ibid*, 01 Mar. 2012, C.R. Alves 88 (HCP 395); 27 Apr. 2012, C.R. Alves 58 (HCP 396); *ibid*, 25 Sep. 2012, C.R. Alves 93 (HCP 412).
LITERATURE: Alves & Cortez (2014)

Cyathus berkeleyanus (Tul. & C. Tul.) Lloyd
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on litter, 19 Jan. 2015, AGS Silva-Filho 106 (HCP 975).
LITERATURE: Cortez et al. (2014)

Cyathus montagnei Tul. & C. Tul.
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on fallen logs, 17 Apr. 2012, leg. C.R. Alves & V.G. Cortez 24 (HCP 244).
LITERATURE: Alves & Cortez (2014)

Cyathus poeppigii Tul. & C. Tul
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, On rotting wood,15 June 2011, leg. V.G. Cortez 004/11 (HCP 241).
LITERATURE: Alves & Cortez (2014)

Cystolepiota hemisclera (Berk. & M.A. Curtis) Pegler
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 01 July 2015, PESC, leg. AGS Silva-Filho 524 (HCP 1121).
LITERATURE: Pegler (1983)

Cystolepiota sp.
EXAMINED SPECIMENS: RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, on litter, 14 Oct. 2015, leg. AGS Silva-Filho 629 (HCP 1206); *ibid*, 04 Dec. 2015, AGS Silva-Filho 726 (HCP 1210).

Lepiota elaiophylla Vellinga & Huijser
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on litter, 9 Nov. 2011, leg. RL Dias 28-3 (HCP 1201)
LITERATURE: Ferreira & Cortez (2013)

Lepiota guatopoensis Dennis × Plate 1F
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on litter, 24 Feb. 2015, leg. AGS Silva-Filho 138 (HCP); *ibid*, 25 May 2015, AGS Silva-Filho 426 (HCP 1130).
LITERATURE: Dennis (1961)
Notes: *Lepiota guatopoensis* is a widely recorded species in Brazil with record in Amazonia, Paraná, Rio Grande do Sul, Rondônia and São Paulo States (Maia et al. 2015). De Meijer (2006) report this species from Dense and Mixed Ombrophilous Forest in eastern Paraná State.

Lepiota lilacea Bres. ✓ Plate 1G
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on litter, 27 Apr. 2015, leg. AGS Silva-Filho 317 (HCP 1128) and 319 (HCP 1129).
LITERATURE: Vellinga (2001)
Notes: *Lepiota lilacea* is characterized by the distinct ring in combination with the squamous covering of the pileo, forming an evident central disc, becoming more sparse towards margin, basidiospores ellipsoid and the pileipellis with clavate elements (Velinga 2001). Is Known in Europe and Sout America (Nordellos et al. 2001). Dennis (1961) recorded *L. lilacea* in Venezuela, Albuquerque et al. (2010) from Rio de Janeiro State, Brazil and now we expanded theirs distribution from Paraná State.

Lepiota sp.1
EXAMINED SPECIMENS: RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, on litter, 24 Feb. 2015, leg. AGS Silva-Filho 152 (HCP 1124).

Lepiota sp. 2
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on litter, 06 Oct. 2015, leg. AGS Silva-Filho 607 (HCP 1125).

Leucoagaricus coerulescens (Peck) J.F. Liang, Zhu L. Yang & J. Xu ☑ Plate 1H–I
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on litter, 27 Nov. 2015, leg. AGS Silva-Filho 666 (HCP 1122). Fazenda Açu, 04 Dec. 2015, AGS Silva-Filho 696 (HCP 1123).
LITERATURE: Liang et al. (2010)
Notes: This mushroom was identified under this name, since it is morphologically much close to this North American species (Liang et al. 2010). It's characterized by white context, clavate to broadly clavate cheilocystidia and the bluish green change of basidiomata when dried but the blue tint did not persist in herbarium collections (Liang et al. 2010). It's known in North America (USA, Peck 1899) and South America (Argentina, Niveiro & Albertó 2013) and now in Brazil.

Leucoagaricus lilaceus Singer
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 24 Mar. 2011, leg. A.J. Ferreira & RL Dias 21-21 (HCP); *ibid* 23 Oct. 2011, A.J. Ferreira & RL Dias 23-10 (HCP); *ibid*, 10 Apr. 2012, leg. A.J. Ferreira & V.G. Cortez 32-1 (HCP); *ibid*, 11 Feb. 2015, leg. AGS Silva-Filho 122 (HCP 1015), 02 Mar. 2015, AGS Silva-Filho 159 (HCP 1020); *ibid*, 13 Apr. 2015, AGS Silva-Filho 252 (HCP 976).
LITERATURE: Ferreira & Cortez (2013)

Leucoagaricus rubrotinctus (Peck) Singer
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 15 May 2012, leg. V.G. Cortez 35-1 (HCP).
LITERATURE: Ferreira & Cortez (2013)

Leucoagaricus sp.
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 01 July 2015, leg. AGS Silva-Filho 522 (HCP 1148).

Leucocoprinus cretaceus (Bull.) Locq.
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 27 Jan. 2011, leg. A.J. Ferreira & RL Dias 17-44 (HCP 1202); *ibid*, 16 Feb. 2011, A.J. Ferreira & RL Dias 18-45 (HCP 1204); *ibid*, 17 Apr. 2012, leg. V.G. Cortez & RL Dias 33-1 (HCP 1205); *ibid*, 23 Apr. 2012, leg. V.G. Cortez 34-4 (HCP 1206); *ibid*, 04 June 2015, leg. AGS Silva-Filho 469 (HCP 1000). RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, 18 May 2015, AGS Silva-Filho 413 (HCP 809).
LITERATURE: Ferreira & Cortez (2013)

Leucocoprinus straminellus (Bagl.) Narducci & Caroti ✓ Plate 1J–K
EXAMINED SPECIMENS: RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, on soil, 18 May 2015, leg. AGS Silva-Filho 422 (HCP 1122).
LITERATURE: Vellinga (2001)
Notes: The pileus light yellow lemon color with granulation at the pileus, the basidiosporos size without a germ-pore are features that differs *L. straminellus* of other related species this genus (Capelari & Gimenes 2004). This is a widespread and

recorded from all Europe (Vellinga, 2001), In Brazil it's Reported only from Rio Grande do Sul State (Guzmán & Guzmám-Davalos 1992) and now from Paraná State.

Lycoperdon perlatum Pers.
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on litter, 27 Feb. 2012, leg. V.G. Cortez & C.R. Alves 17 (HCP 245); *ibid*, 28 May 2012 leg. V.G. Cortez 010/12 (HCP 246).
LITERATURE: Alves & Cortez (2014)

Lycoperdon pyriforme Schaeff.
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, unknown substrate, 02 Mar., 2011, leg. V.G. Cortez 19-26 (HCP 257).
LITERATURE: Alves & Cortez (2014)

Macrolepiota colombiana Franco-Molano
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 10 Oct. 2010, leg. A.J. Ferreira 16-16(HCP 1207); *ibid*, 19 Oct. 2011, AJ Ferreira 27-1 (HCP 1208).
LITERATURE: Ferreira & Cortez (2013)

Morganella afra Kreisel & Dring
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on wood wood and litter, 3 Mar. 2011, leg. A.J. Ferreira & V.G. Cortez 17-32 (HCP 247); *ibid*, 23 Nov. 2011, leg. C.R. Alves 9 (HCP 248) and 14 (HCP 249); *ibid*, 15 May 2012, leg. V.G. Cortez 011/12 (HCP 250).
LITERATURE: Alves & Cortez (2014)

Morganella fuliginea (Berk. & M.A. Curtis)
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wood, 3 Sep. 2011, leg. V.G. Cortez, 14-12 (HCP 252); *ibid*, 12 Sep. 2012, leg. C.R. Alves & V.G. Cortez 02 (HCP 255) and 03 (HCP 256); 23 Apr. 2012, C.R. Alves & V.G. Cortez 49 (HCP 253); *ibid*, 28 May 2012, V.G. Cortez 012/12 (HCP 251).
LITERATURE: Alves & Cortez (2014)

Morganella sulcatostoma C.R. Alves & Cortez
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on remnants of Brazilian Queen Palm (*Syagrus romanzoffiana*), 17 Jan. 2011, leg. A.J.Ferreira & V.G. Cortez 17-18 (UPCB 72893, holotype).
LITERATURE: Alves & Cortez (2013)

Rugosospora pseudorubiginosa (Cifuentes & Guzmán) Guzmán & Bandala
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on litter, 10 Dec. 2010, leg. A.J. Ferreira 15-2 (HCP 1194) and 15-11 (HCP 1195); *ibid*, 27 Jan. 2011, leg. A.J. Ferreira & RL Dias 17-40 (HCP 1196), 17-41 (HCP 1197) and 17-42 (HCP 1198); *ibid.* 27 Apr. 2011, A.J. Ferreira 23-11 (HCP 1199); *ibid*, 23 Apr. 2012, leg. V.G. Cortez 34-5 (HCP 1200). RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, 24 Feb. 2015, AGS Silva-Filho 143 (HCP 1076) and 147 (HCP 967).
LITERATURE: Ferreira & Cortez (2013)

Amanitaceae E.-J. Gilbert

Limacella ochraceolutea P.D. Orton
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on litter of a wood palm tree,19 Oct. 2011, leg. A.J. Ferreira 27-7 (HCP)
LITERATURE: Ferreira et al. (2013).

Bolbitiaceae Singer

Conocybe reticulatorugosa Singer ✕ Plate 1K
EXAMINED SPECIMENS: RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, on decomposing wood, 09 June 2015, leg. AGS Silva-Filho 530 (HCP 990).
LITERATURE: Singer & Digilio (1951)
Notes: *Conocybe reticulatorugosa* is known in Brazil only from Mixed Ombrophilous Forest in eastern Paraná State (de Meijer 2008).

Cortinariaceae R. Heim ex Pouzar

Galerina physospora Singer × Plate 1M–N
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wood, 19 Jan. 2015, leg. AGS Silva-Filho 103 (HCP 1105); *ibid*, 02 Mar. 2015, AGS Silva-Filho 179 (HCP 1175).
LITERATURE: Singer & Digilio (1951)
Notes: *Galerina physospora* is known in Brazil only from Mixed Ombrophilous Forest in eastern Paraná State (de Meijer 2008).

Crepidotaceae Singer

Crepidotus crocophyllus (Berk.) Sacc.
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on litter, 30 Sep. 2010, leg. A.J. Ferreira, R. L.Dias 8-6 (HCP 365); *ibid*, 24 June 2015, leg. AGS Silva-Filho 792 (HCP 1155). UFPR, 24°17'34.43" S and 53°50'31.85" W, 10 Nov. 2015, leg. CBS 04 (HCP 1156).
LITERATURE: Singer (1973)

Crepidotus mexicanus Singer
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wood, 15 Dec. 2015, leg. AGS Silva-Filho 742 (HCP 1190).
LITERATURE: Singer (1973)

Neopaxillus echinospermus (Speg.) Singer
EXAMINED SPECIMENS: PESC 24°18'47.41" S and 53°54'47.11" W, on soil and litter, 19 May 2010, leg. Ferreira A. J. & Souza D. (HCP 339); *ibid*, 02 Mar. 2015, leg. AGS Silva-Filho189 (HCP 707); *ibid*, 27 May 2015, AGS Silva-Filho 337 (HCP 708); *ibid*, 15 June 2015, AGS Silva-Filho AGS-482 (HCP 709). RPPN Fazenda Açú, 24°11'28.05" S and 53°58'6.92" W, 24 Feb. 2015, AGS Silva-Filho 141 (HCP 704); *ibid*, AGS Silva-Filho 144 (HCP 705); *ibid*, AGS Silva-Filho 150 (HCP 706).
LITERATURE: Silva-Filho et al. (2016)

Simocybe tucumana Singer
EXAMINED SPECIMENS: UFPR, 24°17'34.43" S and 53°50'31.85" W, on decomposing wood, 11 Nov. 2015, CBS 04 (HCP 1158); *ibib*, 21 June 2016, CBS 23 (HCP 1159).
LITERATURE: Singer (1973)

Simocybe sp.
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on litter, 27 Nov. 2015, leg. AGS Silva-Filho 687 (HCP).

Entolomataceae Kotl. & Pouzar

Alboleptonia angustospora Largent, Aime & T.W. Henkel
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil decoposing wood 26 Mar. 2013, leg. M. Teixeira-Silva & L.S. Lettrari 074 (HCP 525).
LITERATURE: Henkel et al. (2010)

Alboleptonia sericella (Fr.) Largent & R.G. Benedict
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 02 July 2013, leg. M. Teixeira-Silva & K.S. Cruz 124 (HCP 526); *ibid*, 25 May 2015 leg. AGS Silva-Filho 425 (HCP 996).
LITERATURE: Nordeloos (1987)

Clitocella himantiigena (Speg.) Silva-Filho & Cortez
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil among litter, 09 June 2010, leg. A.J. Ferreira/D. Souza 3.2 (HCP 1019); *ibid*, 22 Jan. 2015, leg. M. Teixeira-Silva 058 (HCP 1018), *ibid*, 11 maio 2015, leg. AGS Silva-Filho 394, HCP (1144). RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, 20 Apr. 2015, AGS Silva-Filho 282, HCP (1016); *ibid*, 04 maio 2015, AGS Silva-Filho 361, HCP (1017).
LITERATURE: Silva-filho et al. (2017b in process)

Clitocella pallescens Silva-Filho & Cortez
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on litter decomposing wood, 02 Mar. 2015, leg. AGS Silva-Filho 172 UPCB (holotype).
LITERATURE: Silva-filho et al. (2017b in process)

PLATE 1. A: *Agaricus* cf. *endoxanthus*. B: *Agaricus* cf. *ochraceosquamulosus*. C–D: *Agaricus purpurellus*. E: *Agaricus volvatulus*. F: *Lepiota guatopoensis*. G: *Lepiota lilacea*. H–I: *Leucoagaricus coerulescens*. J–K: *Leucocoprinus straminellus*. L: *Conocybe reticulatorugosa*. M–N *Galerina physospora*. Scale bar: 25mm.

Entoloma inocephalum (Romagn.) Dennis, Bull.
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wood, 26 Mar. 2013, leg. M. Teixeira-Silva & L.S. Lettrari 078 (HCP 515).
LITERATURE: Largent (1994)

Entoloma subpolitum Largent
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on litter decomposing small branches, 01 Apr. 2011, leg. A.J. Ferreira & R.L. Dias 22-13 (HCP 512).
LITERATURE: Largent (1994)

Leptonia exalbida Largent

EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 18 Dec. 2012, leg. M. Teixeira-Silva 054 (HCP 527).
LITERATURE: Largent (1994)

Nolanea inutilis (Britzelm.) Sacc. & Traverso
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wood, 18 Dec. 2012, leg. M. Teixeira-Silva 053 (HCP 523).
LITERATURE: Largent (1994)

Pouzarella dysthales (Peck) Mazzer
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on rotting wood, 3 June 2013, leg. M. Teixeira-Silva & K.S. Cruz 102 (HCP 482).
LITERATURE: Noordeloos (1979)

Pouzarella ferreri T.J. Baroni
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on rotting wood, 03 Aug. 2013, leg. V.G. Cortez 24-12 (HCP 486); *ibid*, 31 Aug. 2012, leg. M. Teixeira-Silva & V.G. Cortez 006 (HCP 487), *ibid*, 02 July 2013, leg. M. Teixeira-Silva & K.S. Cruz 116 (HCP 488), 117 (HCP 489), 118 (HCP 490), 119 (HCP 491), 120 (HCP 492), 121 (HCP 493), 123 (HCP 494) and 126 (HCP 495).
LITERATURE: Baroni et al. (2008)

Pouzarella sepiaceobasalis (E. Horak) T.J. Baroni
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 23 May 2013, leg. M. Teixeira-Silva 085 (HCP 509).
LITERATURE: Horak (1983)

Pouzarella olivacea T.J. Baroni, Albertó, Niveiro & B.E. Lechner
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 24°18'47.41" S and 53°54'47.11" W, leg. M. Teixeira-Silva 085 (HCP)
LITERATURE: Baroni et al. (2012)

Pouzarella parvispora T.J. Baroni, Albertó, Niveiro & B.E. Lechner
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on litter, 05 June 2013, leg. M. Teixeira-Silva & R. Pozzan 092 (HCP 507) and 093 (HCP 508); *ibid*, 09 June 2015, leg. AGS Silva-Filho 474 (HCP 1054).
LITERATURE: Horak (1983)

Rhodocybe caelatoidea (Fr.) Maire
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on litter, 02 Mar. 2015, leg. AGS Silva-Filho 167 (HCP 1023); *ibid*, 11 May 2015, AGS Silva-Filho 372 (HCP 1025); *ibid*, and 01 July 2015, AGS Silva-Filho 513 (HCP 1024).
LITERATURE: Silva-filho et al. (2017b)

Rhodocybe galerinoides Singer
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil among wood wood 22 Jan. 2013, leg. M. Teixeira-Silva 060 (HCP 514), *ibid*, 11 May 2015, leg. AGS Silva-Filho 393 (HCP 1020). RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, 12 Nov. 2015, AGS Silva-Filho 643 (HCP 1021).
LITERATURE: Silva-filho et al. (2017b)

Rhodocybe sp. 1 section *Rhodocybe*
EXAMINED SPECIMENS: RPPN Fazenda Açu, 07 July 2015, leg. AGS Silva-Filho 536 (HCP).

Rhodocybe sp.2 section *Claudopodes*
EXAMINED SPECIMENS: RPPN Fazenda Açu, on litter, 24°11'28.05" S and 53°58'6.92" W, 14 Oct. 2015, leg. AGS Silva-Filho 634 (HCP 1142).

Rhodocybe sp.3 section *Rufrobrunea*
EXAMINED SPECIMENS: RPPN Fazenda Açu, on soil, 24°11'28.05" S and 53°58'6.92" W, 04 Dec. 2015, leg. AGS Silva-Filho 725 (HCP 1143).

Hygrophoraceae Lotsy

Hygrocybe conica (Schaeff.) P. Kumm. × Plate 2A
EXAMINED SPECIMENS: RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, on soil, 23 June 2015, leg. AGS Silva-Filho 501 [HCP 1038 as *Hygrocybe nigrescens*

var. *Brevispora* (Dennis) Pegler] *ibid*, 04 Dec. 2015, AGS Silva-Filho 728 (HCP 991).
LITERATURE: Pegler (1983, as *Hygrocybe nigrescens* var. *brevispora*)
Notes: This species is recorded only from Paraná and São Paulo State (Maia et al. 2015, as *Hygrocybe nigrescens* var. *Brevispora*). De Meijer (2006) report this species only from Dense Ombrophilous Forest eastern Paraná State.

Marasmiaceae Roze ex Kühner

Crinipellis commixta var. ***commixta*** Singer × Plate 2B–C
EXAMINED SPECIMENS: RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, on wood branches, 24 Feb. 2015, leg. AGS Silva-Filho 133 (HCP 1039).
LITERATURE: Singer (1976)
Notes: *Crinipellis commixta* is a rare species reported in Brazil only from Mixed Ombrophilous Forest in eastern Paraná State (de Meijer 2006).

Crinipellis eggersii var. ***epiphyllus*** Singer × Plate 2D–E
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on bush rope, 09 July 2015, leg. AGS Silva-Filho 532 (HCP 1014).
LITERATURE: Singer (1976).
Notes: *Crinipellis eggersii* is a rare species recorded only from Mixed Ombrophilous Forest in eastern Paraná State (de Meijer 2006).

Crinipellis siparunae Singer
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on litter, 02 Oct. 2015, leg. AGS Silva-Filho AGS-594 (HCP 1107); *ibid*, 06 Oct. 2015, AGS-601 (HCP 1165).
LITERATURE: Singer (1976)

Marasmius cladophyllus Berk.
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, 30 Mar. 2015, leg. AGS Silva-Filho 228 (HCP 1162). RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, 24 Feb. 2015, AGS Silva-Filho 156 (HCP 1160); *ibid*, 20 Apr. 2015, AGS Silva-Filho 290 (HCP 1109); *ibid*, AGS Silva-Filho 733(HCP).
LITERATURE: Singer (1976)

Marasmius graminum var. ***schini*** Singer × Plate 2F
EXAMINED SPECIMENS: RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, on decomposing wood, 14 Oct. 2015, leg. AGS Silva-Filho 625 (HCP 1106)
LITERATURE: Singer (1976)
Notes: This is a rare species reported only by Puccinelli & Capelari (2009) from São Paulo State. De Meijer (2006) reported it from Mixed Ombrophilous Forest, eastern Paraná State.

Marasmius haematocephalus (Mont.) Fr. × Plate 2G
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on litter, 30 Mar. 2015, leg. AGS Silva-Filho 213 (HCP 1151) and 232 (HCP 979). RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, 06 Apr. 2015, AGS Silva-Filho 237 (HCP 1110); *ibid*, 20 Apr. 2015, AGS Silva-Filho 302 (HCP 977).
LITERATURE: Singer (1976)
Notes: *Marasmius haematocephalus* is a common species found decomposing litter in forest, reported from Amazonia, Minas Gerais, Paraná, Pernambuco, Rio Grande do Sul, Rio de Janeiro, Rondonia, São Paulo States (Putzke 1994). De Meijer (2006) recorded this species from Mixed Ombrophilous Forest, eastern of Paraná State.

Marasmius isabellinus Pat. × Plate 2H–I
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wood, 13 July 2015, leg. AGS Silva-Filho AGS-542 (HCP 1011).
LITERATURE: Singer (1976)
Notes: *Marasmius isabellinus* is a rare species recorded in southern Brazil. It is recorded only from Rio Grande do Sul State (Singer 1976) and from Mixed Ombrophilous Forest, eastern Paraná State by de Meijer (2006).

Marasmius lubricus J. S. Oliveira & Cortez
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on fragments of rotten branches, 03 May 2012, leg. C Kozera s/n (HCP 703 isotypus)
LITERATURE: Oiveira & Cortez (2016)

Marasmius neosessilis Singer
EXAMINED SPECIMENS: RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, on decomposing wood, 28 Sep. 2015, leg. AGS Silva-Filho 589 (HCP 1111).
LITERATURE: Singer (1976)

Marasmius sp.1 section *Androsacei*
EXAMINED SPECIMENS: RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, on decomposing branch, 06 Apr. 2015, leg. AGS Silva-Filho 246 (HCP) and 248 (HCP).

Marasmius sp.1 Section *Marasmius*
EXAMINED SPECIMENS: RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, on unknown live host stem, 27 Novermber 2015, leg. AGS Silva-Filho 673 (HCP).

Mycenaceae Overeem

Filoboletus gracilis (Klotzsch ex Berk.) Singer
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wood, 05 May 2015, leg. AGS Silva-Filho 369 (HCP 1062). RPPN Fazenda Açu, 04 May 2015, AGS Silva-Filho 346 (HCP 1063).
LITERATURE: Pegler (1983)

Filoboletus sp.
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wood, 14 Sep. 2016, leg. AGS Silva-Filho AGS-586 (HCP)

Mycena cloroxantha (Fr.) P. Kumm. ✕ Plate 2J
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wood, 01 July 2015, leg. AGS Silva-Filho AGS-511 (HCP 1053); *ibid*, 26 Aug. 2015, AGS Silva-Filho 584 (HCP 999).
LITERATURE: Geesteranus & de Meijer (1997)
Notes: *Mycena cloroxantha* is a rare species recorded only from Paraná State (Geesteranus & de Meijer 1997). De Meijer (2006) report this specie from Dense Ombrophilous Forest, eastern of Parana State.

Mycena euspeirea (Berk. & M.A. Curtis) Sacc. ✓ Plate 2K
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wod, 11 Feb. 2015, leg. AGS Silva-Filho 130 (HCP 970); *ibid*, 16 Mar. 2015, AGS Silva-Filho 209 (HCP 1093); *ibid*, 13 Apr. 2015, AGS Silva-Filho 253 (HCP 1078); *ibid*, 09 June 2015, AGS Silva-Filho 471 (HCP 1071); *ibid*, 24 June 2016, AGS Silva-Filho 791 (HCP 1080).
LITERATURE: Geesteranus (1992)
Notes: *Mycena euspeirea* is belong in Section *Caespitosae* (A. H. Sm.) Maas Geest. along with others species fasciculate-caespitoso that ground in decomposing wood, with white to Orange color and viscous surface (Singer, 1986). The basidiospores size and the gelatinous subhymenium are features that segregate this species of others this secction (Niveiro et al. 2015). This species has distribution in Neotropical region, known in Cuba, Honduras, Venezuela and Brazil (Desjardin et al. 2010). In Brazil is recorded only from Rio Grande do Sul State (Rick 1961) and now we expanded its distribution from Paraná State.

Mycena holoporphyra (Berk. & M.A. Curtis) Singer ✓ Plate 2L
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 27 July 2015, leg. AGS Silva-Filho 558 (HCP), 559(HCP), 560(HCP), 561(HCP), 564(HCP), 568(HCP) and 589(HCP).
LITERATURE: Pegler (1983)
Notes: This species belong in section *Calodontes* (Fr.) subsection *Purae* (Konr. And Maubl) Mass G. (Geesteranus & de Meijer 1997). *Mycena holoporphyra* has entired basidiocarp vinaceus lilac to deep violaceu, lamellae often subporoid, pleurocystidia absent and basidiospores deeply amyloid (Pegler 1983). Our sample collections has longer basidiospores and cheilocystidia compared to those reported in the literature. A more detailed review of this species is required. With widespread in tropical region (Pegler 1987) it is recorded in Ásia, África and América (Niveiro et al. 2011). In South America is known in Colombia Argentina. (Franco-Molano et al. 2010, Niveiro et al. 2011). In Brazil is recorded only from SãoPaulo and Rondonia States. This is the first record from Southern Brazil and from Paraná State.

Mycena obducta Maas Geest. & de Meijer
EXAMINED SPECIMENS: RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, 12 nov. 2015, leg. AGS Silva-Filho 651 (HCP 1036); 657 (HCP 1176), 04 Dez. 2015; *ibid*, AGS Silva-Filho 702 (HCP 1037) and 703 (HCP 1035).
LITERATURE Geesteranus & de Meijer (1997)

Panellus pusillus (Pers. ex Lév.) Burds. & O.K. Mill. ✕ Plate 2M
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wood, 19 Jan. 2015, leg. AGS Silva-Filho 108 (HCP 1177), 30 Jan. 2015, AGS Silva-Filho 118 (HCP 1075); *ibid*, 16 Mar. 2015, AGS Silva-Filho 204 (HCP 1070).
LITERATURE: Pegler (1983, as *Dictyopanus*)
Notes: *Panellus pusillus* is a especies recorded only from Southern Brazil by Loguercio-Leite et al. (2009) from Santa Catarina State and by de Meijer (2006) from Mixed Ombrophilous Forest, eastern Paraná State.

Xeromphalina tenuipes (Schwein.) A.H. Sm. ✕ Plate 2N
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wood, 11 Feb. 2015, leg. AGS Silva-Filho 119 (HCP 974); *ibid*, 13 Apr. 2015, AGS Silva-Filho 250 (HCP 980); *ibid*, 27 July 2015, AGS Silva-Filho 580 (HCP 1174); *ibid*, 14 Sep. 2015, AGS Silva-Filho 587 (HCP 989).
LITERATURE: Pegler (1983)
Notes: This common species found in RPPN Fazenda Açu and São Camilo State Park was recorded from Espirito Santo, Minas Gerais, Paraná, Rio Grande do Sul, São Paulo and Rondonia State (Putzke 1994, Maia et al. 2015). De Meijer (2006) recorded this from Mixed Ombrophilous Forest in eastern Paraná State.

Omphalotaceae Fayod

Gymnopus sp.
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 23 June 2015, leg. AGS Silva-Filho 508 (HCP).

Marasmiellus atrosetosus Dennis ☑ Plate 3A–B
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wood and on stem of unknown live host, 02 Nov. 2015, leg. AGS Silva-Filho 595 (HCP 1108).
LITERATURE: Singer (1973)
Notes: Dennis (1961) described *Marasmiellus atrossetosus* from Venezuela collection. The ellipsoid and amiloid basidiospores, the pileipellis with prostate hyphae with thick-walled brown setae are diagnose features that define this species (Dennis 1961). *Marasmiellus atrosetosus* is known only from Venezuella (Singer 1973) and now its distribution is extended to Brazil.

Marasmiellus distantifolius (Murrill) Singer ✕ Plate 3C
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, in decomposing wood, 30 Jan. 2015, leg. AGS Silva-Filho 117 (HCP 1082); RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, 132 (HCP 1081); *ibid*, AGS Silva-Filho 240 (HCP 1086) and 245 (HCP 1085); *ibid*, and AGS Silva-Filho 590 (HCP 1083).
LITERATURE: Singer (1973)
Notes: *Marasmiellus distantifolius* is a rare species recorded from Brazil, Pegler (1997), report this species in São Paulo State and de Meijer (2006) from Mixed Ombrophilous Forest, eastern Paraná State.

Physalacriaceae Corner

Dactylosporina steffenii (Rick) Dörfelt
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil decomposing buried wood, 15 May 2012, leg. V.G. Cortez 36-01 (HCP 793); *ibid*, 28 May 2012, V.G. Cortez 37-04 (HCP 794); *ibid*, 26 Oct. 2012, V.G. Cortez 42-01 (HCP 795); *ibid*, 24 Feb. 2015, leg. AGS Silva-Filho 146 (HCP 796); *ibid*, 02 Mar. 2015, AGS Silva-Filho 184 (HCP 797); *ibid*, 11-V-2015, AGS Silva-Filho 385 (HCP 798). RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, 01 June 2015, AGS Silva-Filho 459 (HCP 792).
LITERATURE: Petersen & Hunges (2010)

PLATE 2. A: *Hygrocybe conica.* B–C: *Crinipellis eggersii* var. *epiphyllus*. D–E: *Crinipellis commixta var. commixta*. F: *Marasmius graminum* var. *schini.* G: *Marasmius haematocephalus.* H–I: *Marasmius isabellinus.* J: *Mycena cloroxantha*. K: *Mycena euspeirea.* L: *Mycena* aff. *holoporphyra.* M: *Panellus pusillus.* N: *Xeromphalina tenuipes.* Scale bar: 25mm.

Hymenopellis radicata *(Konrad & Maubl.) Bon & Dennis*× Plate 3D
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, 25 Nov. 2010, leg. L.C. Baccin 41-01 (HCP 800).
LITERATURE: Petersen & Hughes (2010)
Notes: Putzke & Pereira (1988) recorded this species from Rio Grande do Sul State and de Meijer (2006) from Dense Ombrophilous Forest in eastern Paraná State.

Oudemansiella cubensis (Berk. & M.A. Curtis) R.H. Petersen
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wood, 10 Dec. 2010, leg. A.J. FerreirA/R.L. Dias 1532 (HCP 802); *ibid*, 25 Oct. 2012, leg. L.C. Baccin 41-02 (HCP- 803); *ibid*, 11 Feb. 2015, leg. AGS Silva-Filho 120 (HCP 804); *ibid*, 27 Apr. 2015, AGS Silva-Filho 305 (HCP 805), 321 (HCP 808) and 333 (HCP 806); *ibid*, 09 June 2015, AGS Silva-Filho 475 (HCP 807). RPPN

Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, 12 Nov. 2015, AGS Silva-Filho 650 (HCP 810).
LITERATURE: Petersen & Hughes (2010)

Pleurotaceae Kühner

Hohenbuehelia angustata (Berk.) Singer
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, decomposing wood, 04 May 2015, leg. AGS Silva-Filho 352 (HCP 1140).
LITERATURE: Thorn & Barron (1986)

Hohenbuehelia bullulifera Singer
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wood, 30 Sep. 2010, leg. A.J. Ferreira & R.L. Dias 8-4 (HCP 364), 8-8 (HCP 366).
LITERATURE: Singer & Digilio (1951)

Hohenbuehelia mastrucata (Fr.) Singer
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wood, 19 Jan. 2015, leg. AGS Silva-Filho 110 (HCP 1005); *ibid*, 02 Mar. 2015, AGS Silva-Filho 166 (HCP 1007); *ibid*, 16 Mar. 2015, AGS Silva-Filho 201 (HCP 1004); *ibid*, 25 May 2015, AGS Silva-Filho 436 (HCP 1006). RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, 14 Oct. 2015, Silva-Filho 613 (HCP 1002) and 614 (HCP 1003).
LITERATURE: Thorn & Barron (1986)

Hohenbuehelia paraguayensis (Speg.) Singer
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wood, 02 Mar. 2015, leg. AGS Silva-Filho 165 (HCP 1009); *ibid*, 13 Apr. 2015, AGS Silva-Filho 256 (HCP 1008); *ibid*, 27 July 2015 AGS Silva-Filho 581 (HCP 1010).
LITERATURE: Singer & Digilio (1951)

Hohenbuehelia portegna (Fr) Singer
EXAMINED SPECIMENS: RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, on decomposing wood, 06 June 2015, leg. AGS Silva-Filho 461 (HCP 1139); *ibid*, 14 Oct. 2015, AGS Silva-Filho 631 (HCP 1001).
LITERATURE: Singer & Digilio (1951)

Hohenbuehelia sp.
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wood, 01 June 2015, leg. AGS Silva-Filho 528 (HCP); RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, 14 Oct. 2015, AGS Silva-Filho 623 (HCP).

Pleurotus opuntiae (Durieu & Lév.) Sacc. ✓ Plate 3E–F
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on unknown decomposing wood, 29 June 2016, leg. AGS Silva-Filho 793 (HCP 1134)
LITERATURE: Muños & Amaia (2013)
Notes: *Pleurotus opuntiae* is a described from Algeria by Durieu & Léville as *Agaricus opuntiae* Durieu & Lév. and the Saccardo (1887) made the combination in P. opuntiae. This mushroom that growing on *Oputia* sp. has as diagnose the basidiospores size and the cheilocystidia lecythiform with globose capitulum at apex. *Pleurotus opuntiae* is recorded also growing on *Agave* spp., *Yuccca* spp., *Phytolaca* spp. (Durieu & Léville 1849). Pegler (1977) register *P. opuntiae* on *Acacia* spp., genus known in Seasonal Semidecidual Forest. With worldwid distribution this specie is recorded in Europe, Africa and America (Camacho et al. 2012) In Brazil is recorded only from Amapá State (Sótão et al 1991) and now we recorded this specie from Paraná State.

Pluteaceae Kotl. & Pouzar

Pluteus argentinensis Singer
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 19 Oct. 2011, leg. R.L. Dias 27-4 (HCP).
LITERATURE: Dias & Cortez (2013)

Pluteus cervinus (Schaeff.) P. Kumm.

EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, PESC, 16 Sep. 2011, leg. R.L. Dias 6-1 (HCP).
LITERATURE: Dias & Cortez (2013)

Pluteus globiger Singer
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil decomposing wood, 12 Sep. 2011, leg. R.L. Dias 25-1 (HCP).
LITERATURE: Dias & Cortez (2013)

Volvariella bombycina (Schaeff.) Singer
EXAMINED SPECIMENS: RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, on decomposing wood, 11 Apr. 2015, leg. AGS Silva-Filho 300 (HCP 1116).
LITERATURE: Pegler (1983)

Volvariella taylori (Berk. & Broome) Singer
EXAMINED SPECIMENS: PESC, 224°18'47.41" S and 53°54'47.11" W, on litter, 6 Oct. 2015, leg. R.L. Dias 12-01 (HCP 1117).
LITERATURE: Pegler (1983)

Psathyrellaceae Vilgalys, Moncalvo & Redhead

Copelandia cyanescens (Berk. & Br.) Singer
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on dung cow, 25 May 2015, leg, AGS Silva-Filho 439 (HCP 1027) and 440, (HCP 1028); *ibid*, 21 June 2016, Silva-Filho 783 (HCP 1030)
LITERATURE: Silva-Filho et al. (2017a)

Copelandia mexicana Guzmán
EXAMINED SPECIMENS: RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, on litter, 15 June 2015, leg. AGS Silva-Filho 491 (HCP 1031); *ibid*, 14 Oct. 2015, AGS Silva-Filho 632 (HCP 1032); *ibid*, 12 Nov. 2015, AGS Silva-Filho 641 (HCP 1033).
LITERATURE: Silva-Filho et al. (2017a)

Coprinellus disseminatus (Pers.) J.E. Lange × Plate 3G
EXAMINED SPECIMENS: RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, on decomposing wood, 20 Apr. 2015, leg. AGS Silva-Filho 299 (HCP 968).
LITERATURE: Pegler (1983)
Notes: This is a common species found in southern Brazil. It is recorded from Rio Grande do Sul, São Paulo, Santa Catarina and Paraná State (Maia et al. 2015). From Paraná it was reported from Mixed Ombrophilous Forest in eastern region (de Meijer 2006).

Coprinellus sp. section *Micacei*
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 06 Oct. 2015, leg. AGS Silva-Filho 600 (HCP 1132).

Coprinellus sp. section *Tomentosi*
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wood, 14 Sep. 2015, leg. AGS Silva-Filho 588 (HCP 1133).

Panaeolus antillarum (Fr.) Dennis
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on dung cow, 18 June 2016, leg. AGS Silva-Filho 793 (HCP 1168).
LITERATURE: Silva-Filho et al. (2017c in process)

Panaeolus papilionaceus (Bull.) Quél.
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on dung cow, 18 June 2016, leg. AGS Silva-Filho 798 (HCP 1167) and 799 (HCP 1166); *ibid*, 23 June 2016, AGS Silva-Filho 801 (HCP 1152) and 803 (HCP 1170).
LITERATURE: Silva-Filho et al. (2017c in process)

Panaeolus silvaticus Silva-Filho, Seger & Cortez
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, 27 Apr. 2015, leg. AGS Silva-Filho 322 (HCP 1214); *ibid*, 09 June 2015, AGS Silva-Filho 478 (UPCB holotype); *ibid*, 12 Nov. 2015, 639 (HCP 1215). RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, 01 June 2015, AGS Silva-Filho 444 (HCP 1216);

ibid, 20 July 2015, AGS Silva-Filho 549 (HCP 1217); *ibid*, 30 Oct. 2015, AGS Silva-Filho 636 (HCP 1218).
Literature: Silva-Filho et al. (2017c in process)

Parasola leiocephala (P.D. Orton) Redhead, Vilgalys & Hopple
EXAMINED SPECIMENS: RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, on decomposing wood, 18 May 2015, leg. AGS Silva-Filho 409 (HCP 1059).
LITERATURE: Schafer (2014)

Psathyrella sp. section *Atricataneae*
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wood, 27 Nov. 2015, leg. AGS Silva-Filho 667 (HCP).

Hymenogastraceae Vittad.

Psilocybe yungensis Singer & A.H. Sm. ☑ Plate 3H
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wood, 16 Mar. 2015, leg. AGS Silva-Filho 206 (HCP 978); *ibid*, 27 Apr. 2015, AGS Silva-Filho 335 (HCP 1065). RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, AGS Silva-Filho 638.
LITERATURE: Guzmán (1983)
Notes: *Psilocybe* aff. *yungensis* was described by Singer & Smith (1958) from Bolivian collection. This species is found in clusters or gregariously on root wood and is diagnosed by the habit and habitat along with the microscopic features as: the basidiospores pleurocystidia and cheilocystidia formate and size (Stamets 1996). A more detailed revision of this specie with recorded specimens of Colombia Equador and México (Stamets 1996) are needed to conclude if this is a new taxon.

Gymnopilus chrysopellus (Berk. & M.A. Curtis) Murrill ☑ Plate 3I
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wood, 6 Mar. 2015, leg. AGS Silva-Filho 206 (HCP 978); *ibid*, 27 May 2015, AGS Silva-Filho 335 (HCP 1065); *ibid*, 27 Apr. 2015, AGS-306 (HCP 1092), and 328 (HCP 1090); *ibid*, 06 Oct. 2015, AGS-609 (HCP 1091). RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, 20 Apr. 2015, AGS-301 (HCP 1089).
LITERATURE: Singer & Digilio (1951)
Notes: *Gymnopilus chrysopellus* is described by Bereley & Curtis (1969, as *Agaricus chrysopellus*) from Wrights' collections in Cuba. This species ground on decomposing wood, the pileus size varies between 10–110 mm in wide, has basidiospores smooth, ellipsoid to subglobose, cheilocystidia lageniform some with cilindric neck (Singer & Digilio 1951). It's a widespread distribution species in America (North, Central and South, Murril 1913, Pegler 1983, Singer & Digilio 1951). It's the first record from Brazil.

Tricholomataceae R. Heim

Asproinocybe guzmani Silva-Filho & Cortez
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil decomposing wood, 26 Mar. 2013, leg. L.S. Lettrari & M. Teixeira-Silva 073 (UPCB Holotype). RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, 04 May 2015 leg. AGS Silva-Filho 341 (HCP).

Clitocybe ramigena H.E. Bigelow
EXAMINED SPECIMENS: RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, decomposing wood, 09 Mar. 2015, leg. AGS Silva-Filho 193 (HCP 1071) and 197 (HCP 1145)
LITERATURE: Bigelow (1982)

Dennisiomyces glabrescentipes Singer ✖ Plate 3J
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 09 Mar. 2015, leg. AGS Silva-Filho 518 (HCP 992).
LITERATURE: Pegler (1983)
Notes: *Dennisiomyces glabrescentipes* is a rare species described by Singer (1955) from Pernambuco State. De Meijer report *D. glabrescentipes* from East of Paraná State in Mixed Ombrophilous Forest.

Dennisiomyces rionegrensis Singer ✖ Plate 3K

EXAMINED SPECIMENS: RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, on litter, 24 Feb. 2015, leg. AGS Silva-Filho 135 (HCP 1088) and 149 (HCP 1087), *ibid*, 04 Dec. 2015, AGS Silva-Filho 700 (HCP 1013).
LITERATURE: Singer (1989)
Notes: This is a common species found in RPPN Fazenda Açu. Singer (1989) described this species from Amazonia State. De Meijer (2006) recorded from Dense Ombrophilous Forest in eastern Paraná State

Lepista sordida (Schumach.) Singer × Plate 3L
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil decomposing wood, 30 Mar. 2015, leg. AGS Silva-Filho 219 (HCP 1073) and 230 (HCP 1172); *idib*, 11 May 2015, AGS Silva-Filho 378 (HCP 1171); *ibid*, 01 July 2015, AGS Silva-Filho 527 (HCP 995). RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, AGS Silva-Filho 09 Mar. 2015, Silva- Filho 191 (HCP 1072); *ibid*, 18 May 2015, AGS Silva-Filho 416 (HCP 1058), *ibid*, AGS Silva-Filho 485 (HCP 1056).
LITERATURE: Murril [1914 as *Melanoleuca sordida* (Schum.) Murill]
Notes: This is a common species found in RPPN Fazenda Açu and São Camilo State Park, but few recorded in southern Brazil. Reported only from São Paulo and Paraná State (Pegler 1997, de Meijer 2006). From Paraná it was reported only from Mixed Ombrophilous Forest in eastern region (de Meijer, 2006).

Lepista sp.
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on litter, 27 Apr. 2015, leg. AGS Silva-Filho 331 (HCP 1136) and 334 (HCP 1137).

Leucopaxillus basiliensis (Rick) Singer & A.H. Sm.
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil, 11 May 2015, leg. AGS Silva-Filho 370 (HCP 1061). RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, 18 May 2015, AGS Silva-Filho 404 (HCP 1060).
LITERATURE: Pegler (1983)

Leucopaxillus gracillimus Singer & A.H. Sm.
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on soil decomposing wood, 11 Feb. 2015, leg. AGS Silva-Filho 128 (HCP 971); *ibid*, 02 Mar. 2015 AGS Silva-Filho 170 (HCP 966).
LITERATURE: Pegler (1983)

Resupinatus alboniger (Pat.) Singer
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, decomposing wood, 30 Jan. 2015, leg. AGS Silva-Filho 115 (HCP 972); *ibid*, 01 July 2015, AGS Silva-Filho 517 (HCP 1050). RPPN Fazenda Açu, 24°11'28.05" S and 53°58'6.92" W, 04 Feb. 2015, AGS Silva-Filho 137 (HCP 969).
LITERATURE: Thorn & Barron (1986)

Tricholosporum meridionale Silva-Filho & Cortez
EXAMINED SPECIMENS: RPPN Fazenda Açú, 24°11'28.05" S and 53°58'6.92" W, on litter, 15 June 2015, leg. AGS Silva-Filho 490 (UCPB Holotype); *ibid*, 04 Dec. 2015, AGS Silva-Filho 715(HCP).

Tricholosporum tropicale Guzmán, Bandala & Montoya
EXAMINED SPECIMENS: RPPN Fazenda Açú, 24°11'28.05" S and 53°58'6.92" W, on litter, 18 May 2015, leg. AGS Silva-Filho 403 (HCP 1112); *ibid*, 01 June 2015, AGS Silva-Filho 450 (HCP 1113); *ibid*, 15 June 2015, AGS Silva-Filho-487 (HCP 1114); *ibid*, 04 Dec. 2015, AGS Silva-Filho 692 (HCP 1115).
LITERATURE: Guzmán et al. (1994)

***Tricholosporum* sp.**
EXAMINED SPECIMENS: RPPN Fazenda Açú, 24°11'28.05" S and 53°58'6.92" W, on litter, 15 June 2015, leg. AGS Silva-Filho 483 (HCP).

Tubariaceae Vizzini

Tubaria bispora Matheny, P.-A. Moreau, M.A. Neves & Vellinga ☑ Plate 3M
EXAMINED SPECIMENS: PESC, 24°18'47.41" S and 53°54'47.11" W, on decomposing wood, 09 June 2016, leg. Silva-Filho 476 (HCP 1103).
LITERATURE: Matheny et al. (2007)
Notes: Matheny et al. (2007) describe this species from Costa Rica and Martinique. The basidiomes reddish brown with cortinate ring, spore deposit brown, spores not

collapsed when revived in 3% and basidia two spored are feature that distinguish *T. bispora* from others this genus. Our sample collection has smaller basidioma, narrow spores compared with American central specimens.

PLATE 3. A–B: *Marasmiellus atrosetosus*. C: M*arasmiellus distantifolius*. D: *Hymenopellis* cf. *radicata*. E–F *Pleurotus opuntiae*. G: *Coprinellus disseminates*. H: *Psilocybe* aff. *yungensis*. I: *Gymnopilus chrysopellus*. J: *Dennisiomyces glabrescentipes* K: *Dennisiomyces rionegrensis*. L: *Lepista sordida*. M: *Tubaria* aff. *bispora*. Scale bar: 25mm.

Conclusion

A total of 633 spp. were colected in RPPN Fazenda Açu and São Camilo State Park in 2015, in which 21% where identified and deposited in HCP Herbarium. Of this total 75 sp. were identified to the specific level and other 28 sp. already identified in previous studies of fungi agaricales in the same

locality since 2010 were aggregates to this research. Thus in the Seasonal Semidecidual Forest fragments of Western Paraná were totalized 103 sp. of Agaricales S.L. identified between 2010 and 2016. *Asproinocybe guzmani*, *Calvatia guzmanii, Clitocella pallescens, Marasmius lubricus, Morganella sulcatostoma, Tricholosporum meridionale*, *Panaeolus silvaticus* were new species proposed from specimens collected in these fragments and published in other papers (Alves & Cortez 2013, Alves & Cortez 2014, Oliveira & Cortez 2016, Silva-Filho et al 2017b, Silva-Filho et al. 2017c).

So far are registered six new records from Brazil, five from Paraná State and twenty one from Seasonal Semidecidual Forest. The 79% not identified to specific level were separated and grouped in genus, highlighting *Pluteus* Fr., *Lepiota* P. Browne, *Mycena* (Pers.) Roussel and *Marasmius* Fr. as most diverse genus. The specimens not identified and the others 17 specimes identified as sp. remain being studied by other researchers and may represent new taxa or new records.

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11 CONSIDERAÇÕES FINAIS

O estudo sobre fungos *Agaricales* junto a fragmentos de Floresta Estacional semidecidual, contribuiu de forma significativa para o conhecimento da micobiota local, ainda pouco explorada, assim como também para o conhecimento da biodiversidade de organismos nesse ecossistema.

O ano 2015 foi um ano com bom índice pluvial e chuvas bem distribuídas. Houve uma estiagem apenas durante os meses de agosto e setembro. Isso refletiu o grande número e a diversidade de amostras coletadas. Tendo em vista o grande volume de trabalho e o tempo gasto para processar esse material, muitas espécimes não puderam ser estudadas.

Como Agaricales s.l. é um grupo muito diverso morfológicamente, não foi possível trabalhar ou analisar todos os grupos. Foi dado enfase para os mais diversos, ou os que não foram estudados ainda na região, como *Tricholomataceae*, *Marasmiaeae*, *Agaricaceae*, *Crepidotaceae,* e gêneros que já eram estudados como *Rhodocybe* e *Hohenbuehelia*. Ainda assim outros gêneros muito abundante e pouco estudados como *Mycena* e *Pluteus,* continuam em estudo por outros alunos de mestrado e de graduação. Sendo assim futuras novidades taxonômicas serão publicadas apartir dessas coletas.

Contudo o objetivo proposto no trabalho foi alcançado, já que apartir dessa pesquisa *Clitocella pallescens* e *Panaeolus silvaticus* são descritas como novas para a ciência. Espécies de *Tricholosporum*, antes desconhecidas para a América do Sul passam a ser reportadas a partir de coletas em Floresta Estacional Semidecidual. O gênero Clitocella também passa a ser conhecida no Brasil. Outras 29 são novas ocorrências para Floresta Estacional Semidecidual do estado do Paraná. *Agaricus ochraceosquamulosus, Clitocella himantiigena, Gymnopilus chrysopellus, Lepiota lilacea, Leucoagaricus coerulescens, Marasmiellus atrosetosus* e *Rhodocybe galerinoides* têm sua distribuição ampliada para o Brasil. *Agaricus endoxanthus, Crepidotus crocophyllus, Hohenbuehelia mastrucata, Leucocoprinus straminellus, Mycena euspeirea, Mycena holoporphyra, Pleurotus opuntiae e Psilocybe yungensis* são novos registros para o Estado do Paraná.

Desse modo, é possível que estudos morfológicos aqui realizados juntamente com dados moleculares, possa a vir gerar dados mais precisos e que venham também a contribuir para publicar novas espécies e/ou até a participar de estudos filogenéticos.

Agaricales, representa um grupo bastante diverso nos estudos de diversidade de Fungos s.l. no Brasil e em Mata Atlântica s.l. Revela-se um campo prolífico para a pesquisa taxonômica no subtrópico sul-brasileiro.

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